

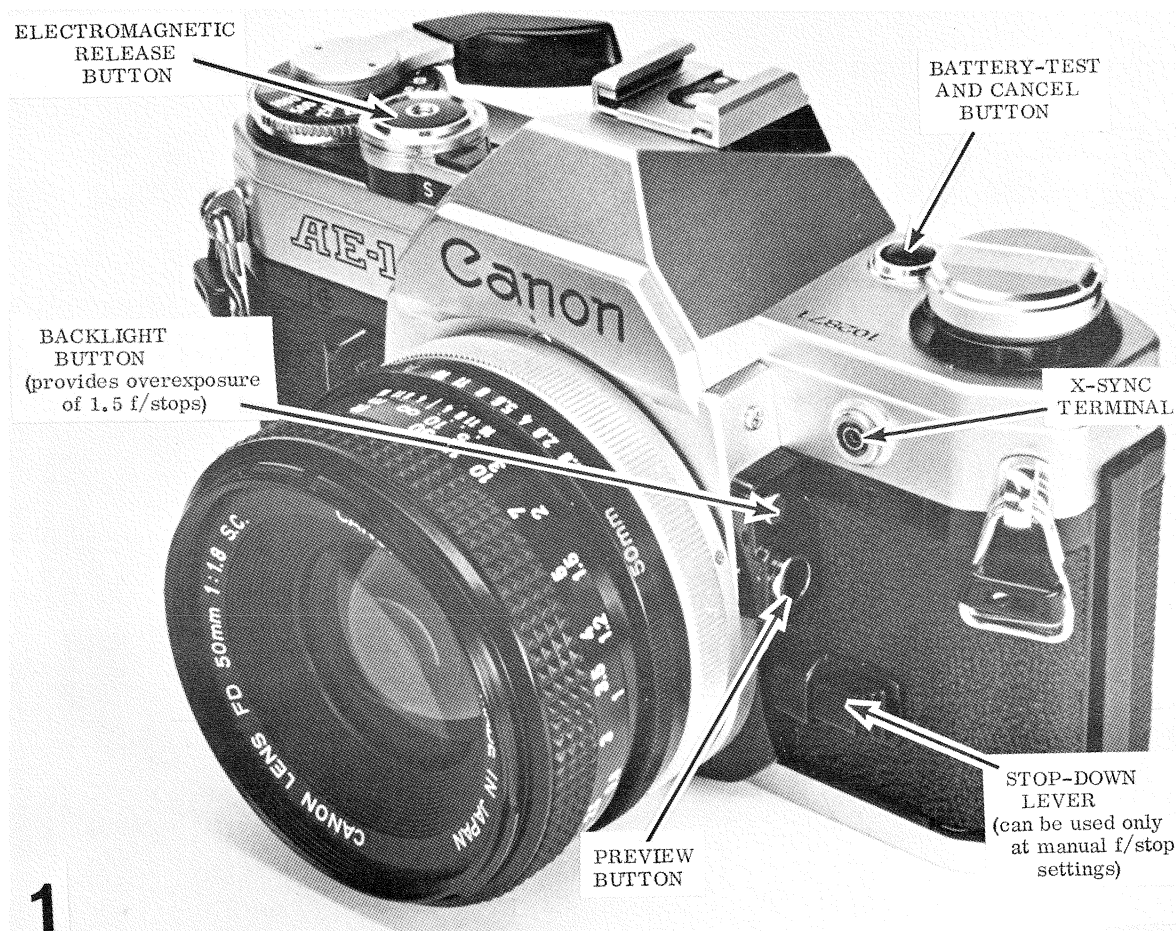


Canon

AE-1

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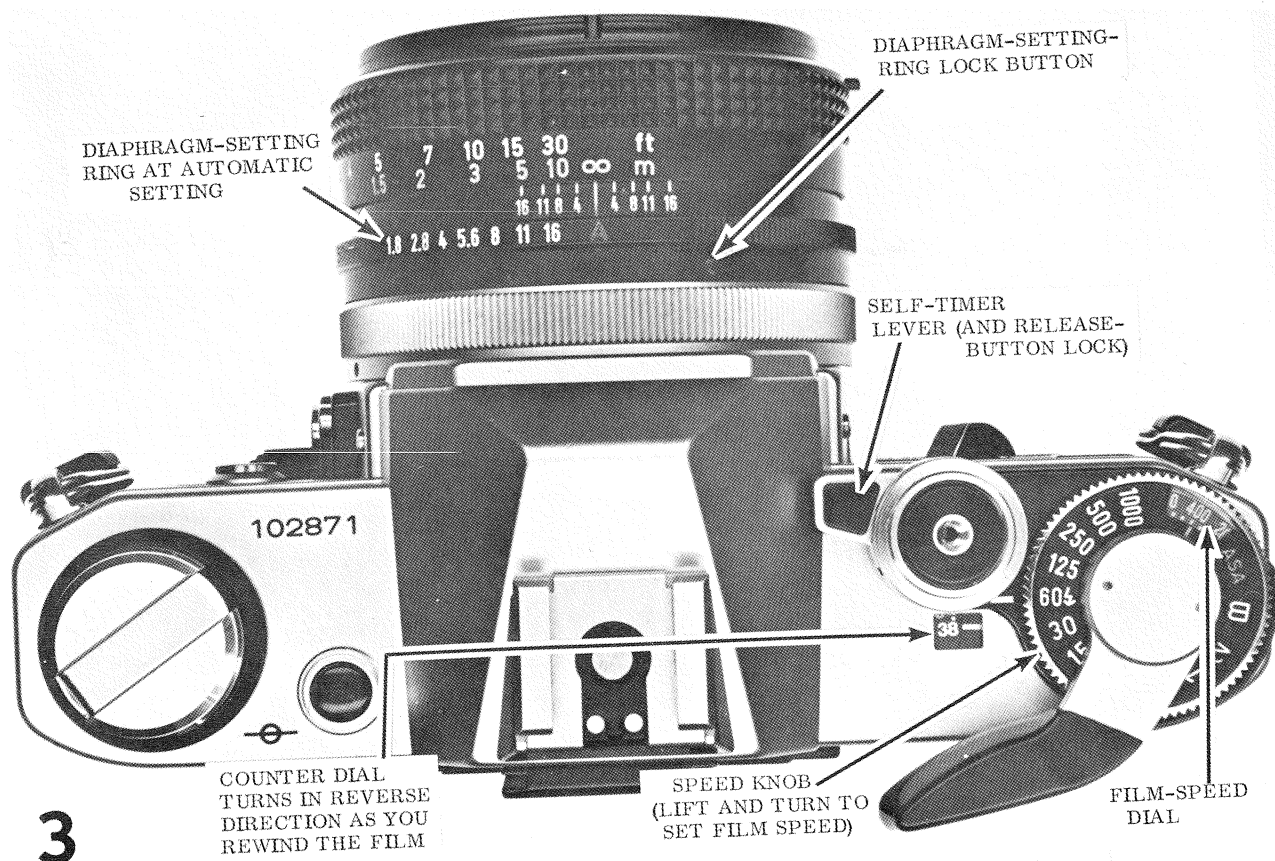


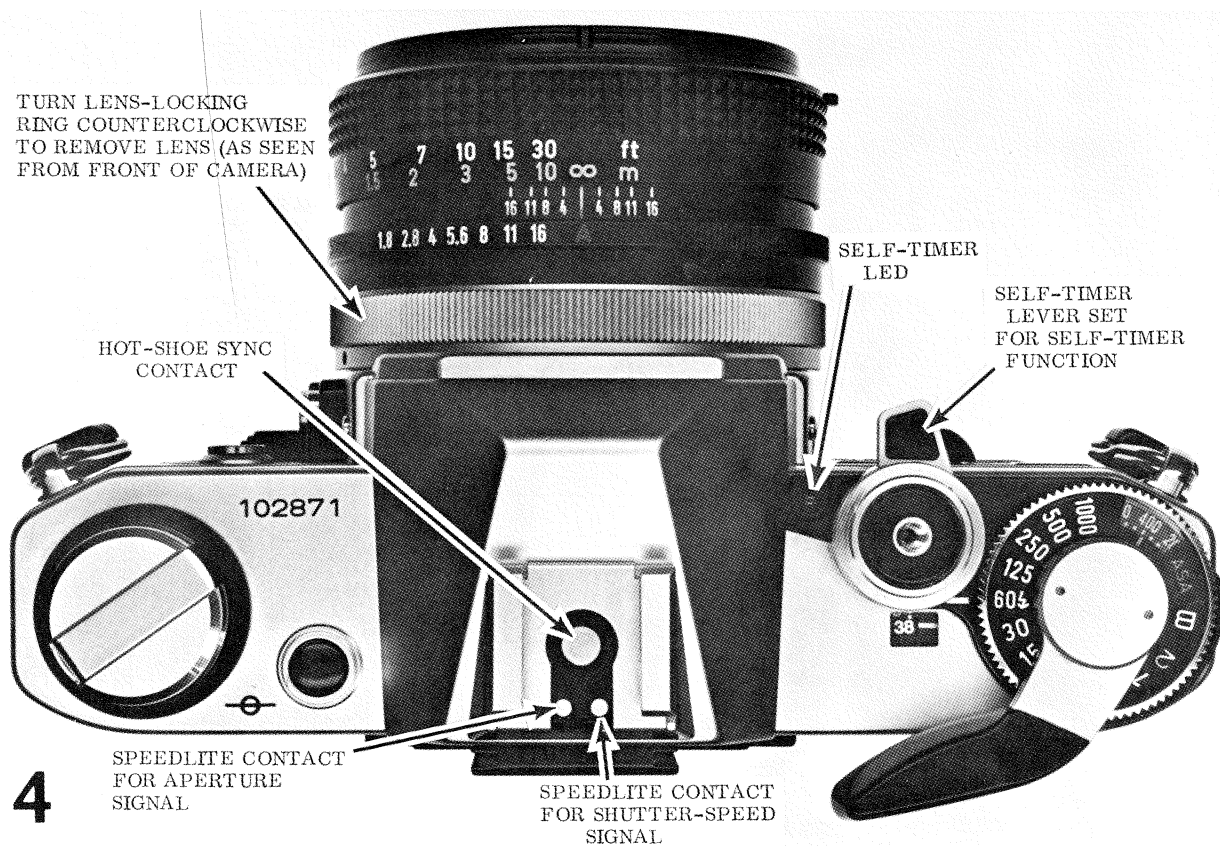
You can lock the stop-down lever at the stopped-down position when you're set to a manual f/stop setting. You can then use the FL lenses with stopped-down metering.

Suppose that your diaphragm-setting ring is at "A" and you decide to use the depth-of-field preview. You turn the diaphragm-setting ring to a manual setting and push in the stop-down lever. But before you return the diaphragm-setting ring to the "A" position, set the largest aperture. Otherwise, the camera won't program the aperture automatically.

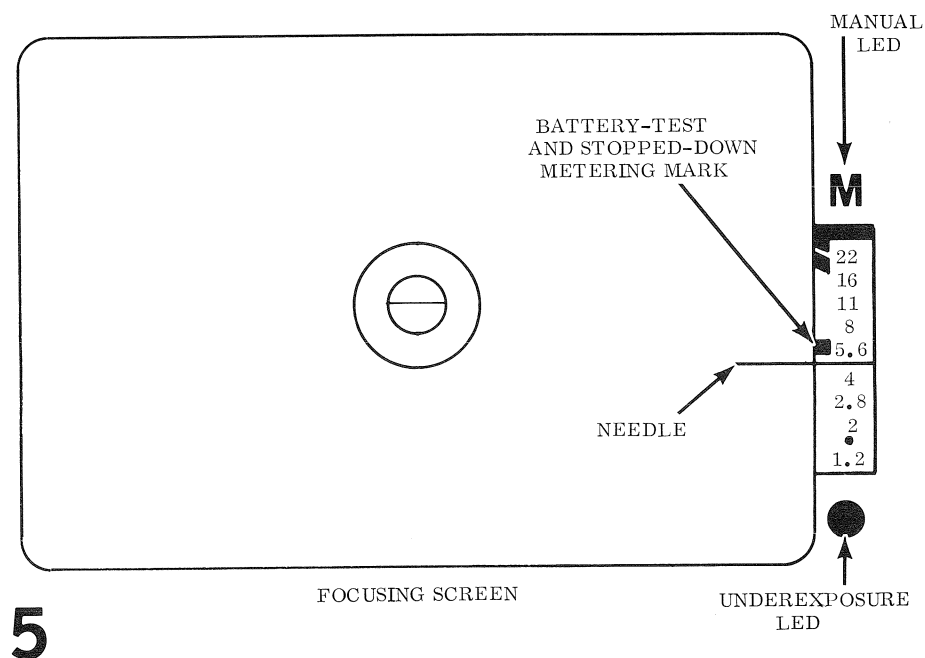
BATTERY COMPARTMENT FOR 6-VOLT SILVER-OXIDE BATTERY





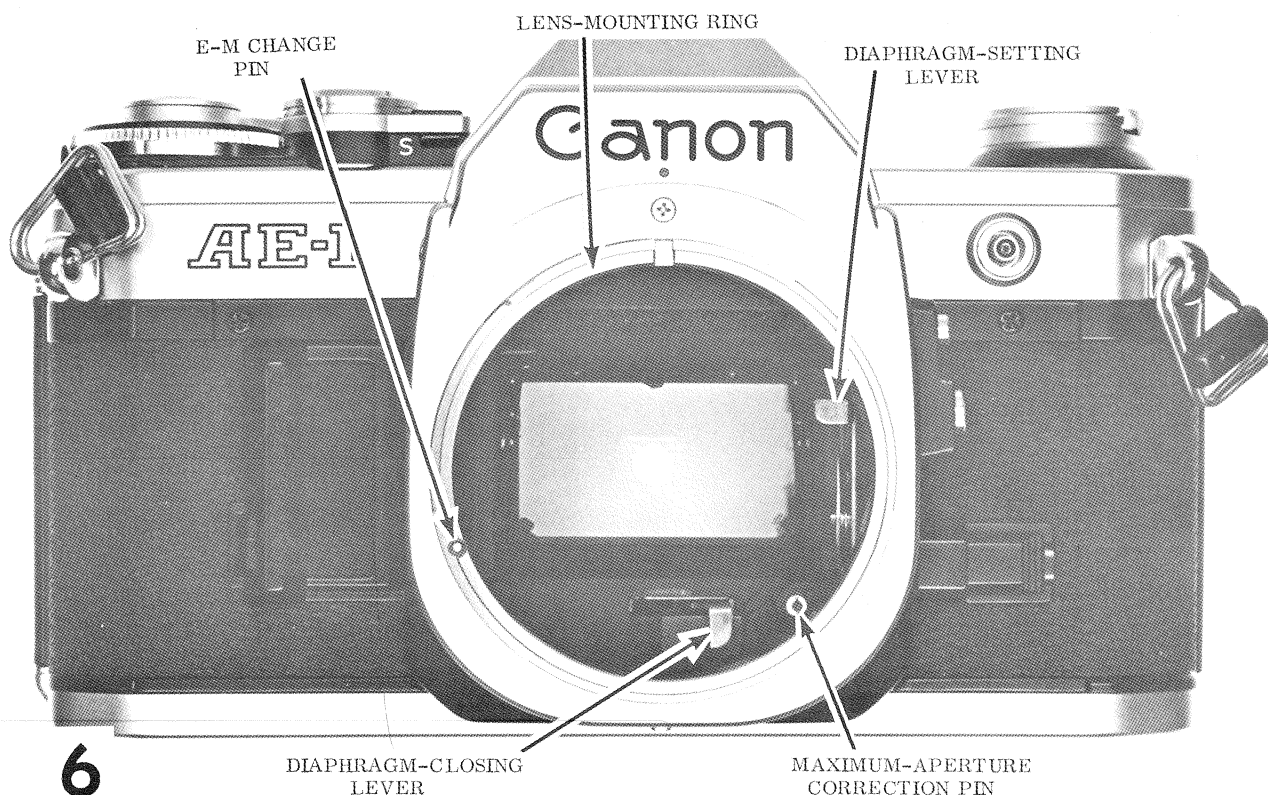


The self-timer function delays the shutter release for 10 seconds. During the self-timer operation, the self-timer LED flashes on and off twice a second (2 Hz).



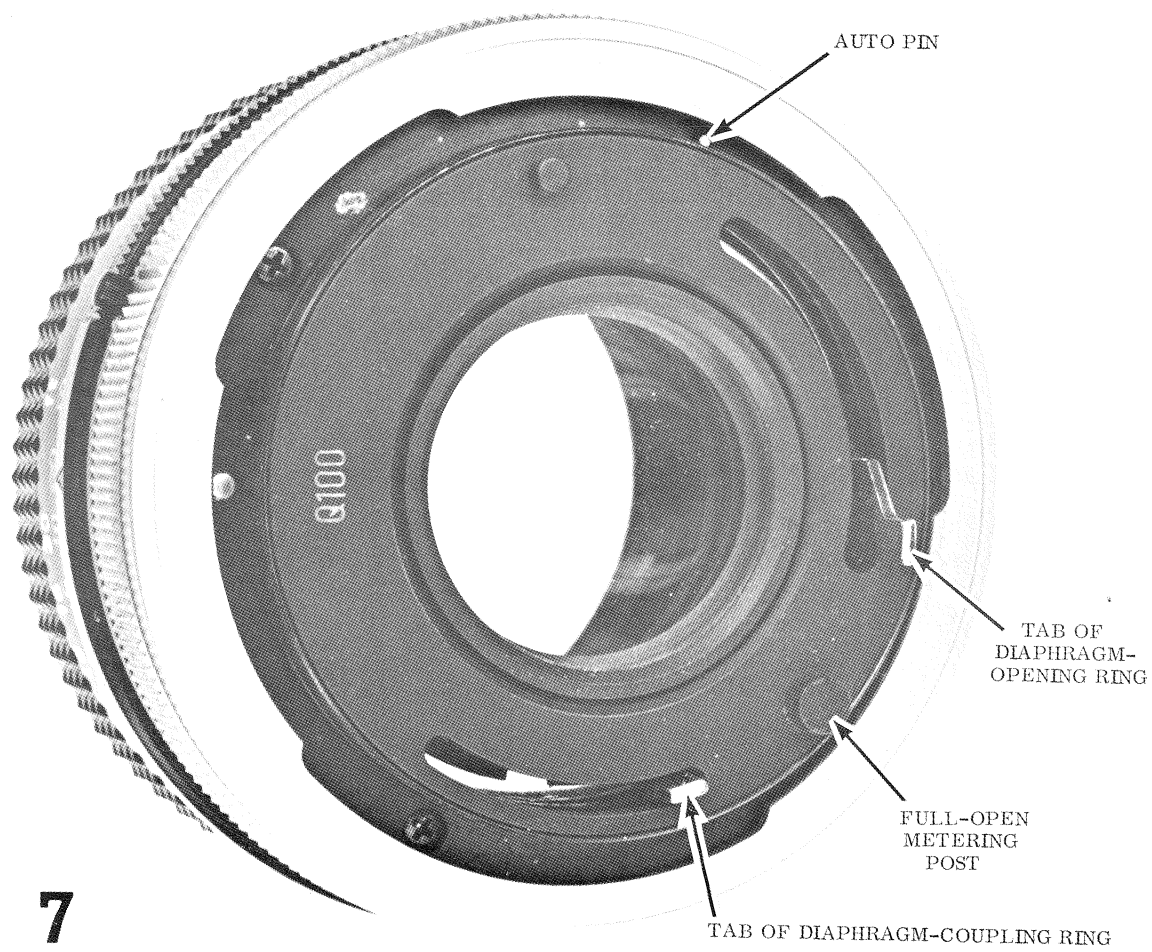
There are two warning LED's visible through the finder. If you're set to a manual f/stop, the LED at the top of the aperture scale flashes on and off as you start depressing the release button. The LED then illuminates the letter "M" for "manual." A second LED at the bottom of the aperture scale flashes on and off to warn of underexposure. Both LED's flash at 4 Hz.

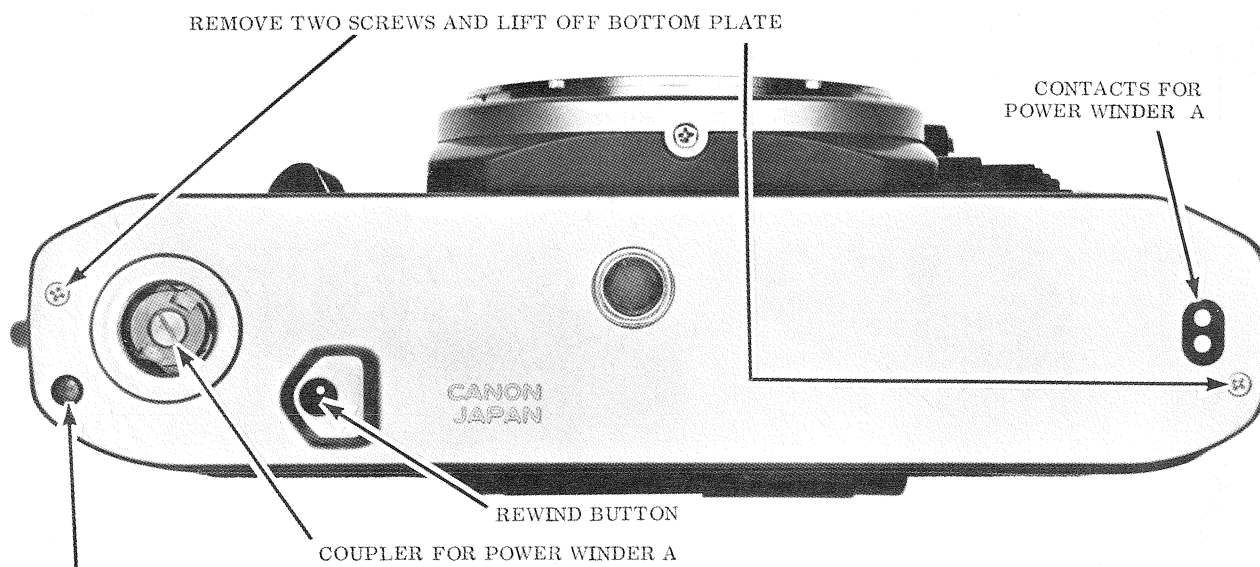
When you push the battery-test button, the needle should move to the battery-test mark or below it. The battery-test mark also provides the stopped-down-metering mark when you're using the FL lenses.



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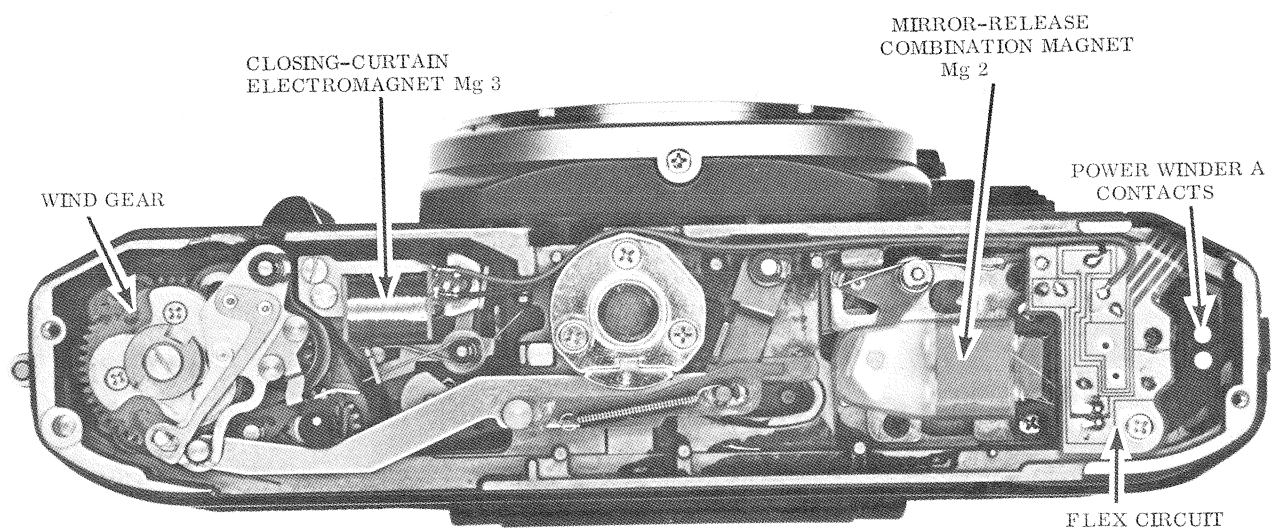
The front surface of the maximum-aperture correction pin should be 5.7mm (+0, — 0.2mm) from the front surface of the lens-mounting ring. To make the adjustment, first loosen the setscrew in the center of the maximum-aperture correction pin. You can then turn the maximum-aperture correction pin clockwise to increase the distance. To decrease the distance, turn the maximum-aperture correction pin counterclockwise and turn in the setscrew to hold the adjustment.





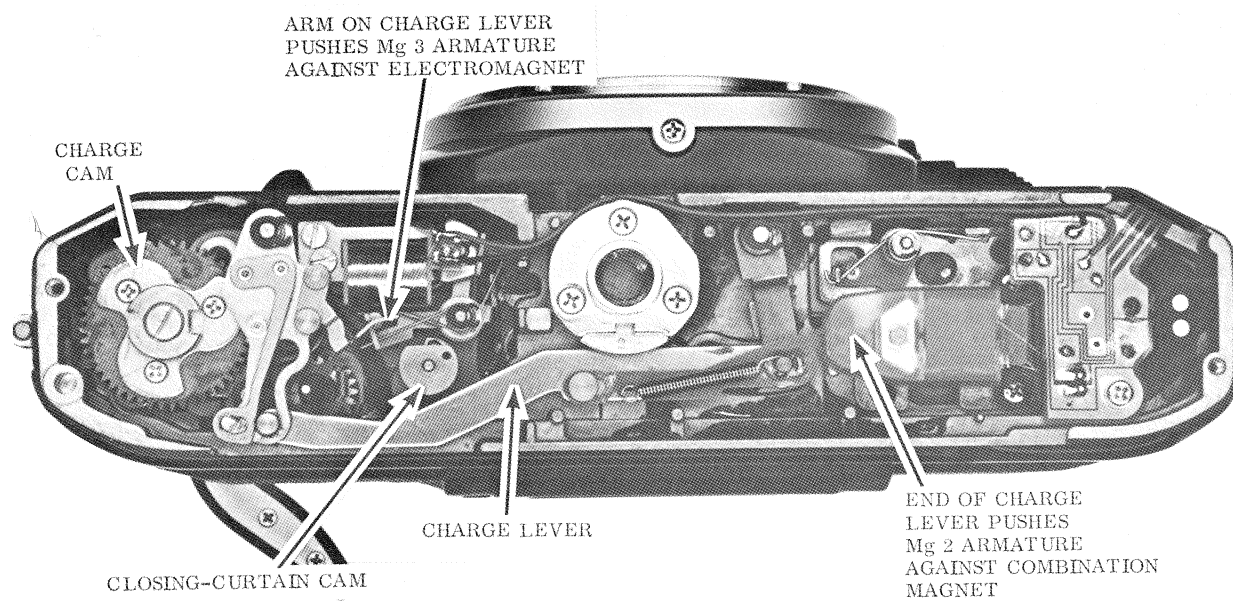
CAUTION: BUSHING FOR POWER WINDER A LOCATING PIN MAY BE LOOSE

8



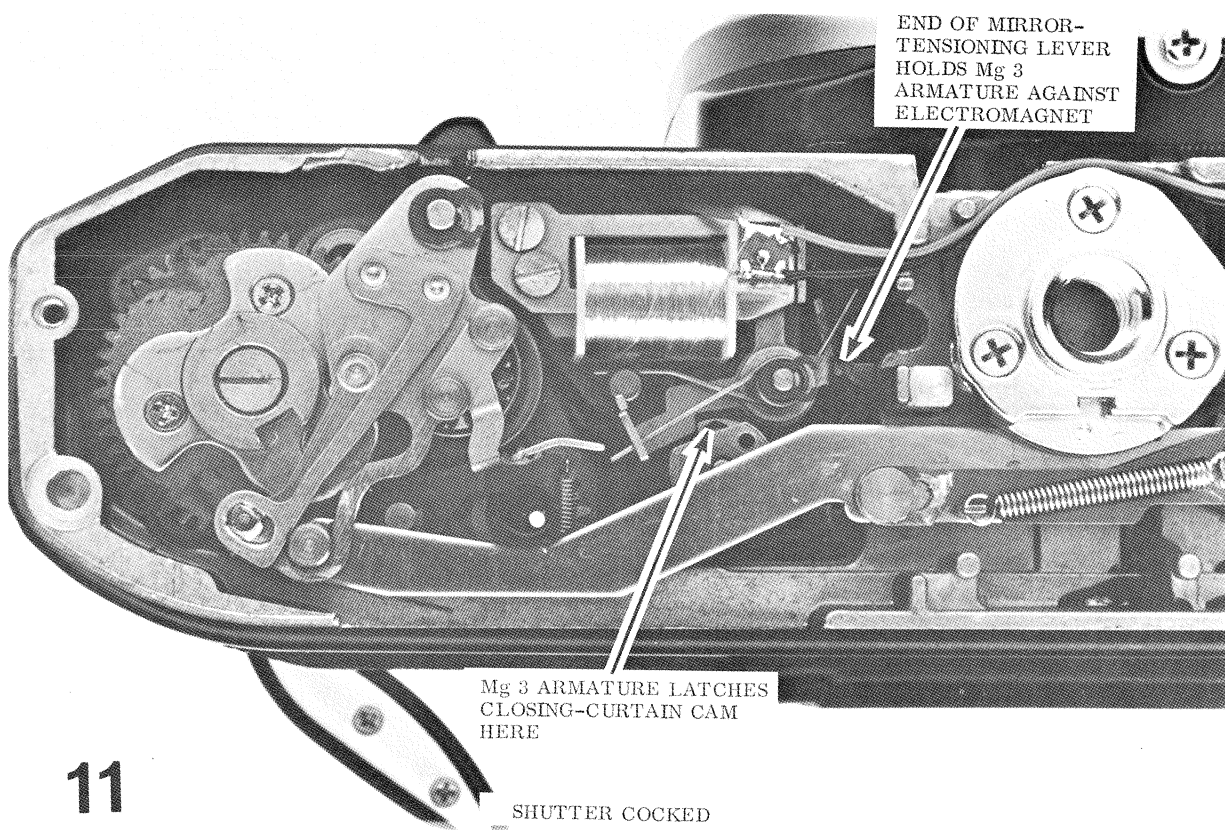
9

SHUTTER RELEASED

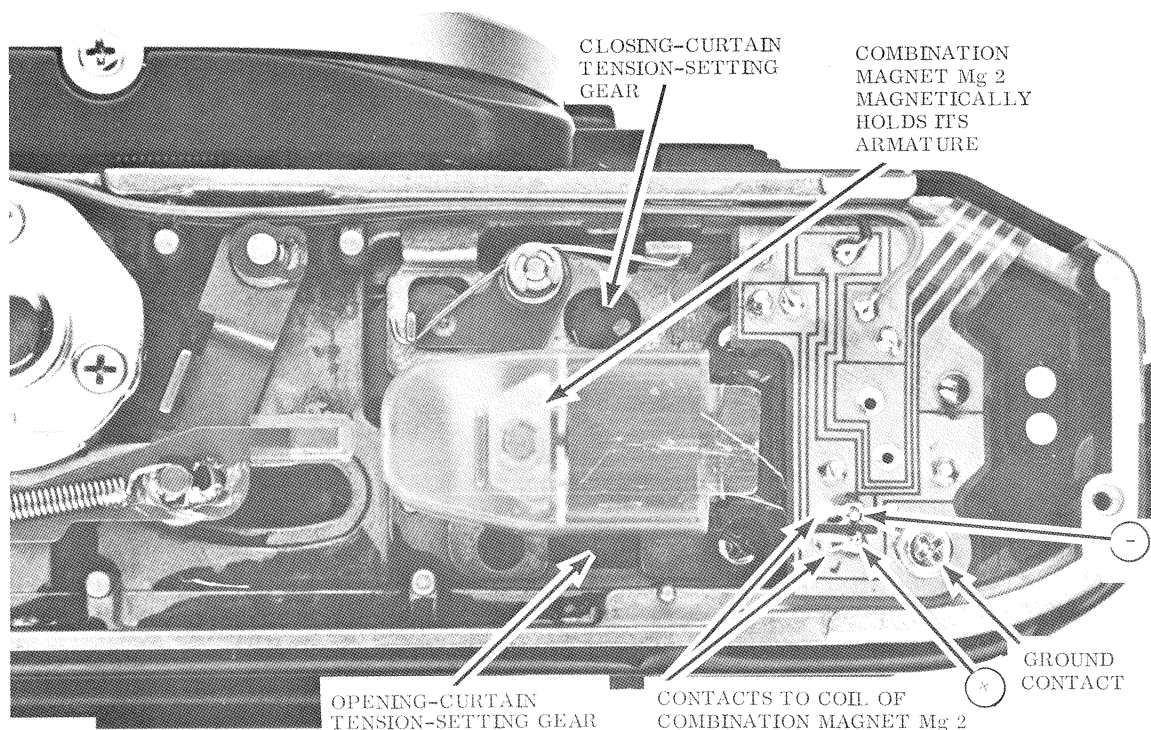


DURING COCKING CYCLE

10



In the shutter-cocked position, the overtravel measured between the latching surface of the closing-curtain cam and the Mg3 armature should be 0.05 - 0.15mm. Make the overtravel adjustment by first loosening the two allen-head screws on the closing-curtain cam. Then, rotate the closing-curtain cam to change the overtravel.



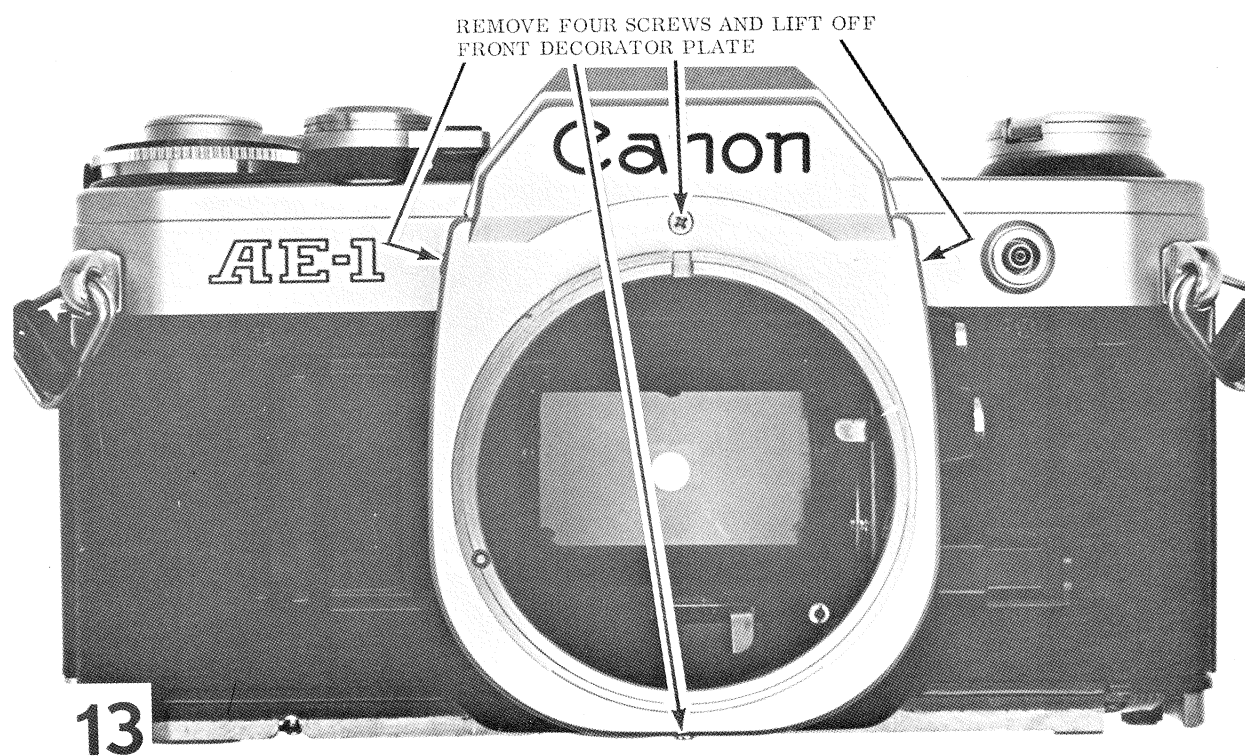
12

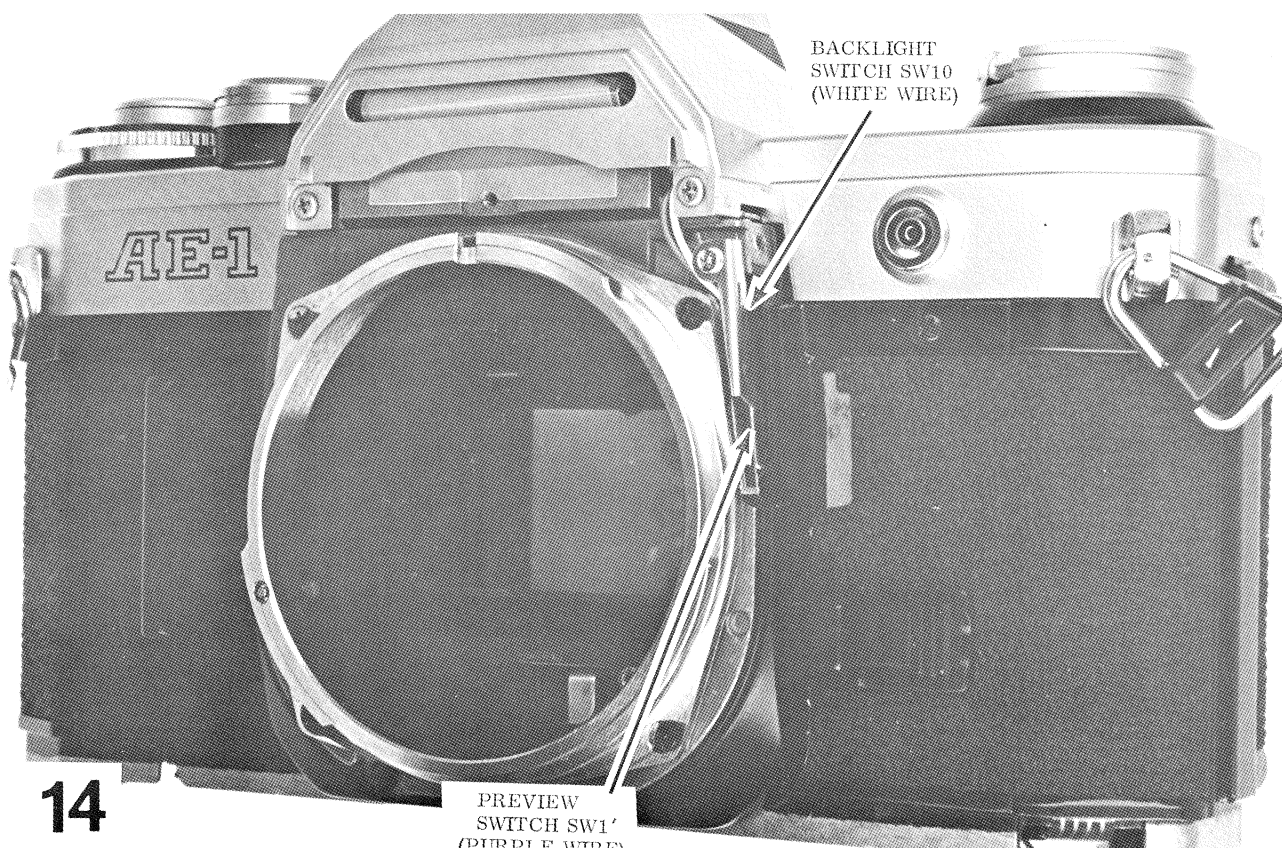
SHUTTER COCKED

When you depress the release button, a spurt of current flows through the Mg2 coil. That reverses the polarity of the permanent magnet. And the permanent magnet releases the armature to disengage the mirror.

You can test the Mg2 coil by applying 2 volts from a power supply to the two coil connections on the flexible circuit board. With the polarity noted on the photograph, the Mg2 armature should release.

It's possible to reach both curtain-tension adjustments without removing the combination magnet. Turn the tension-setting gears clockwise to decrease the tension, counterclockwise to increase the tension. The proper curtain-travel time is 11.3 ms.

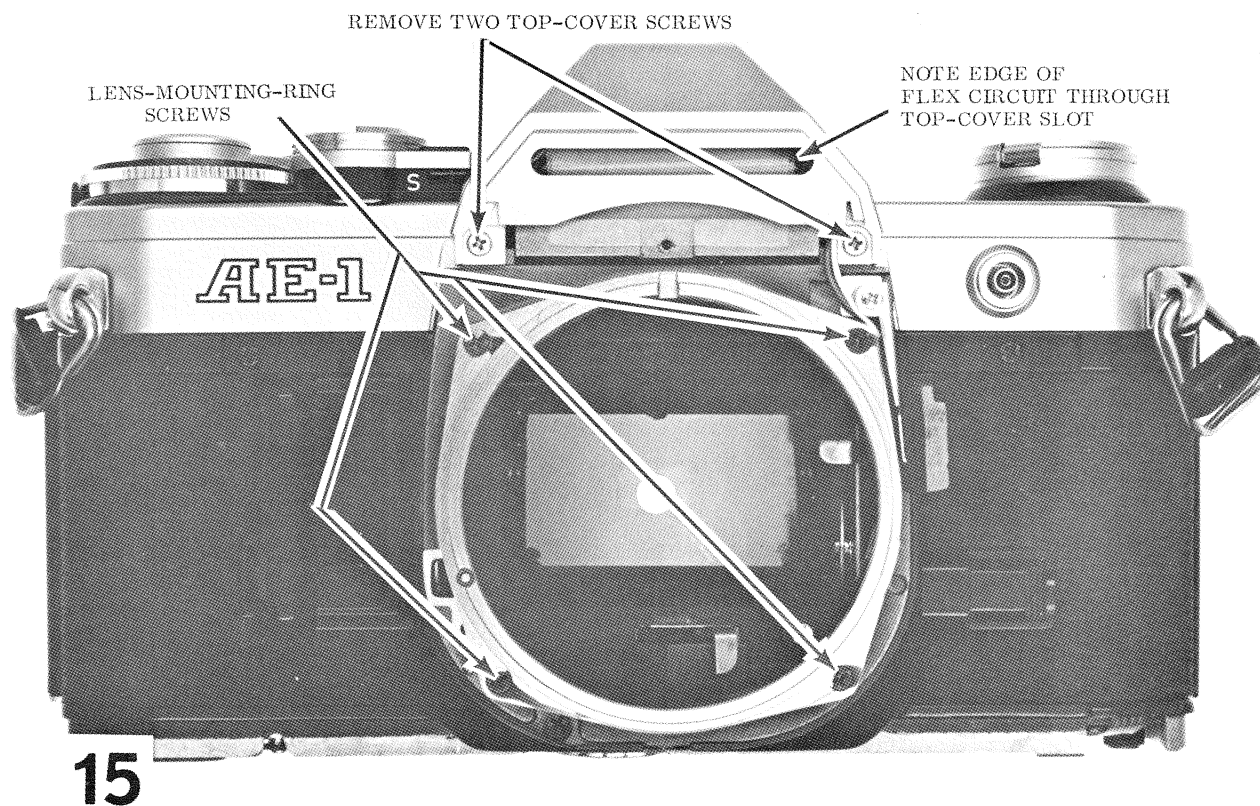




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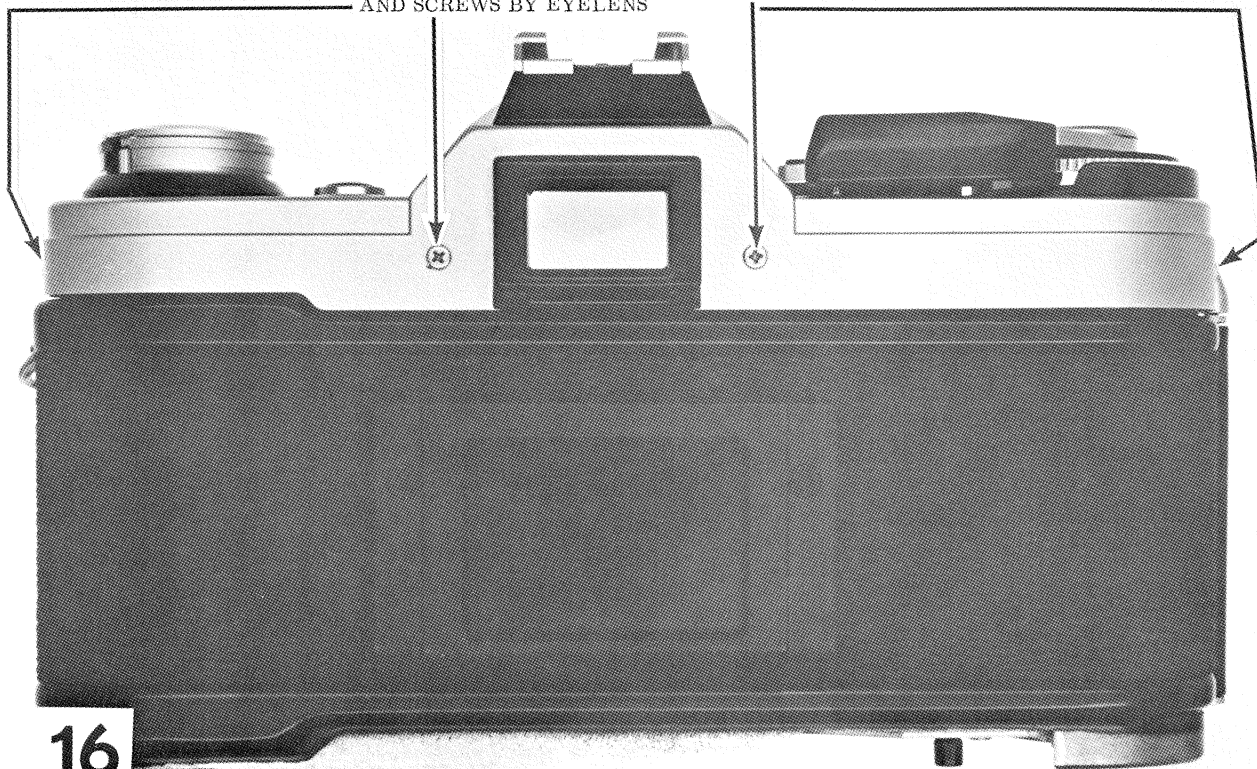
BACKLIGHT
SWITCH SW10
(WHITE WIRE)

PREVIEW
SWITCH SW1'
(WHITE WIRE)

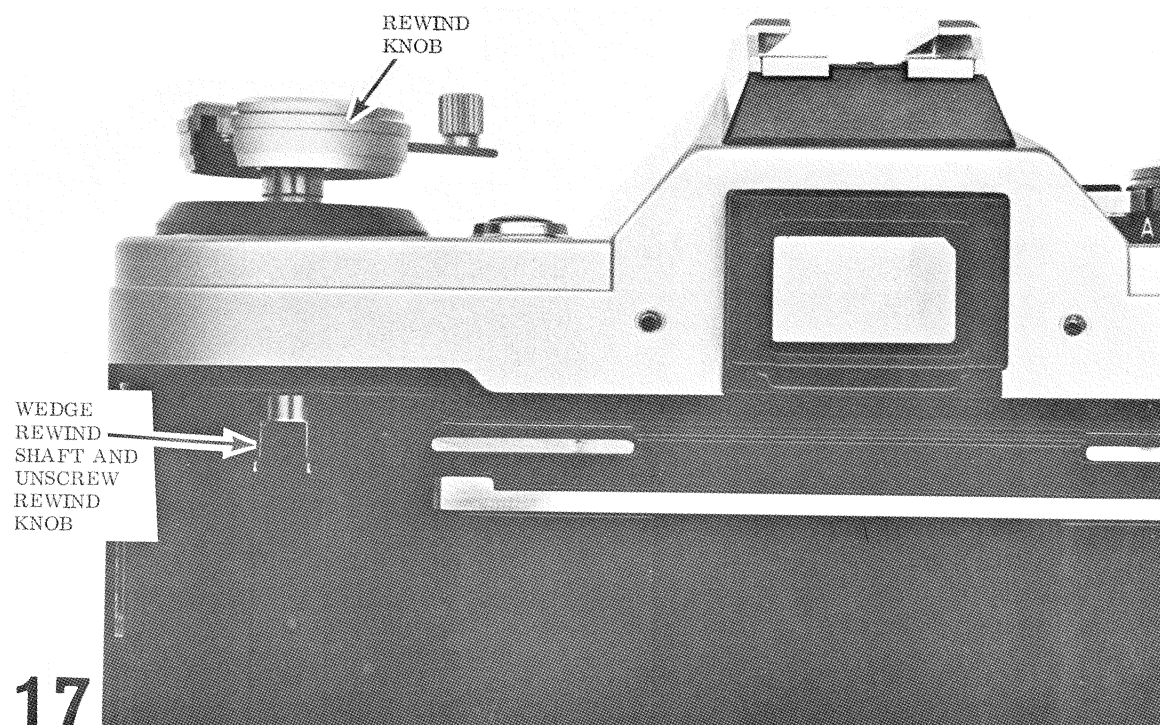


Washers under the lens-mounting ring control the flange-focal distance and parallelism. Adjust the flange-focal distance to 41.9mm between the front of the lens-mounting ring and the film-guide rails -- or to 42.14mm between the lens-mounting ring and the pressure-plate rails.

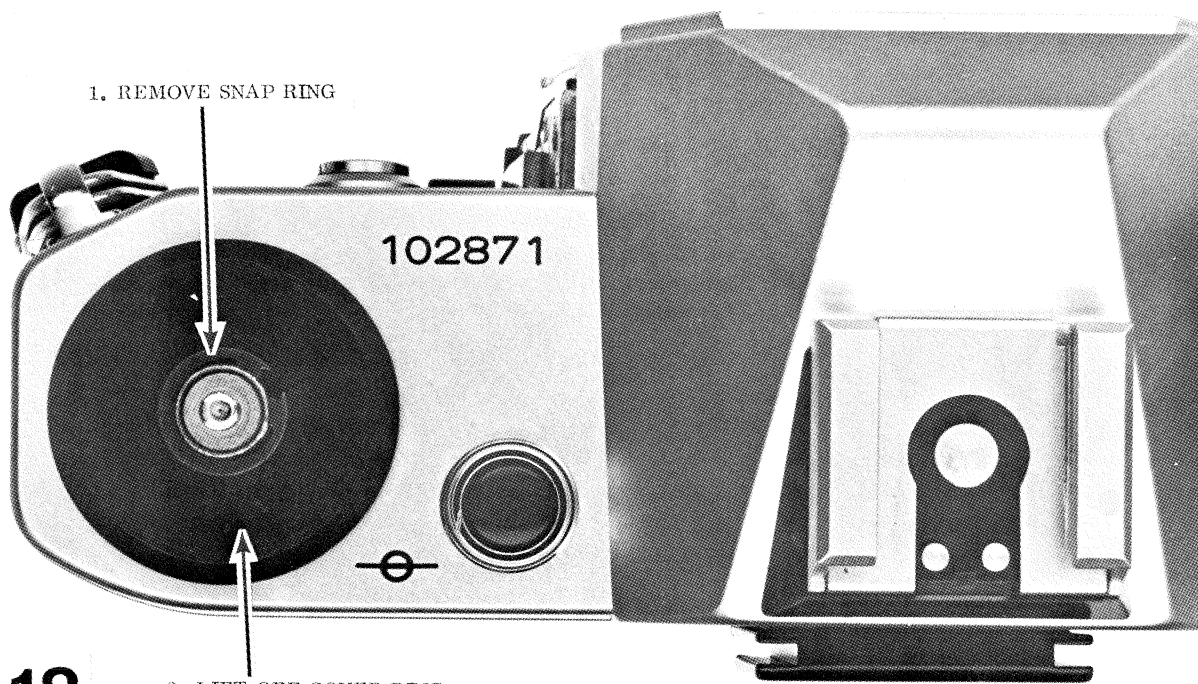
REMOVE SCREWS AT ENDS OF TOP COVER
AND SCREWS BY EYELENS



16



17

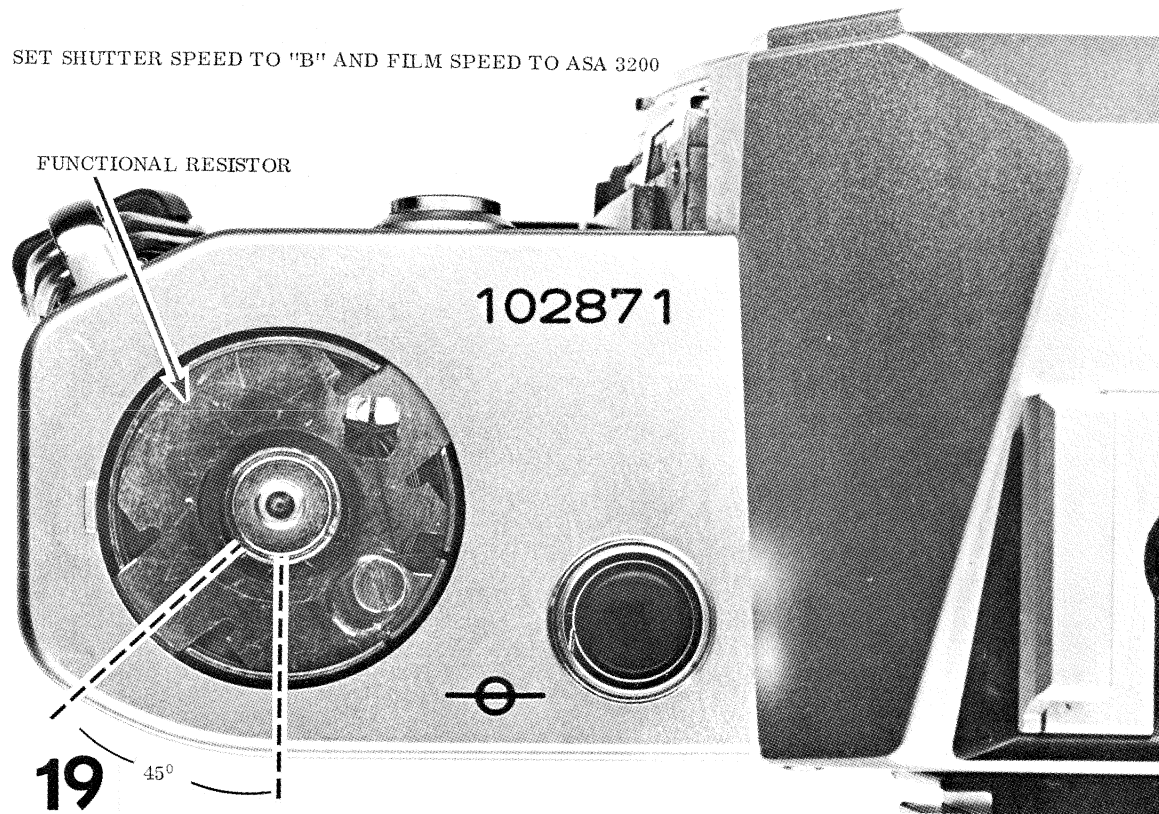


18

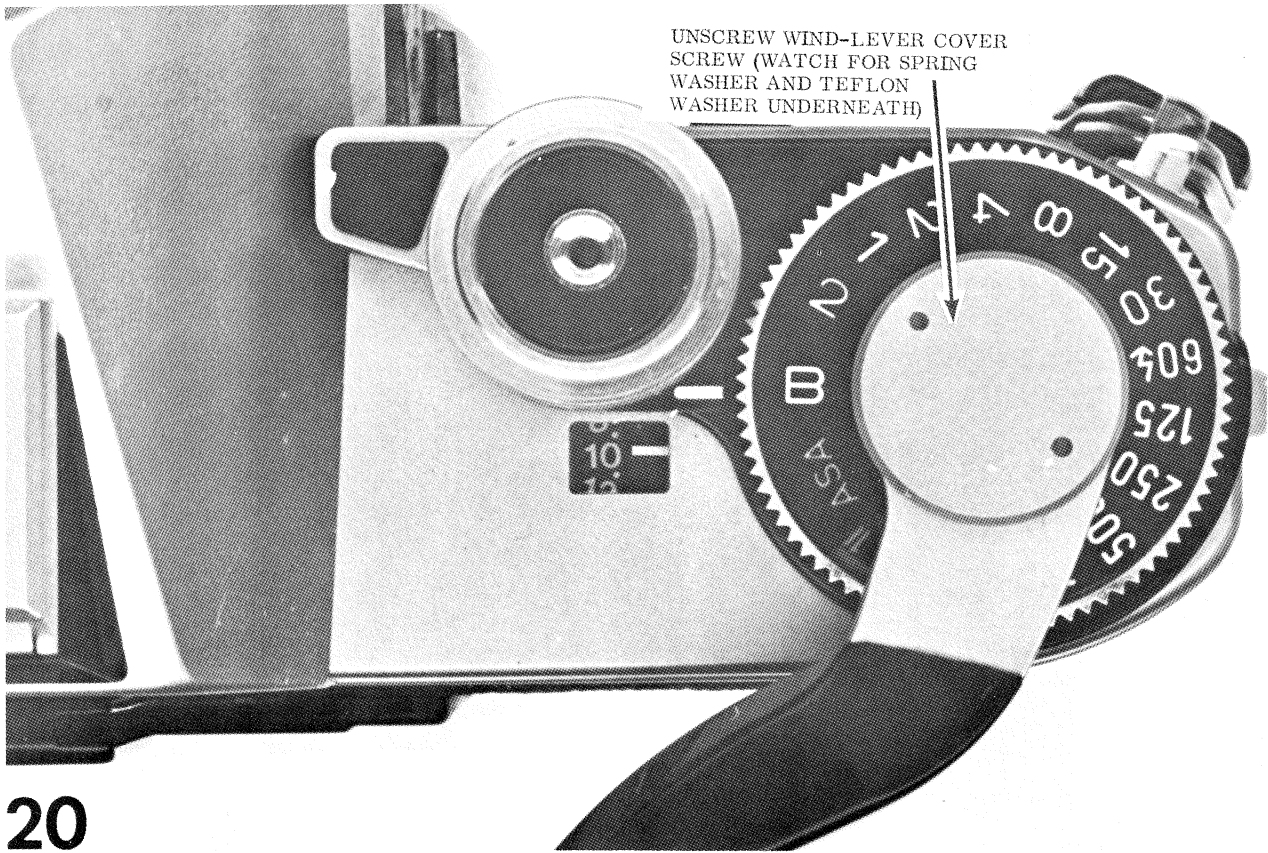
2. LIFT OFF COVER RING

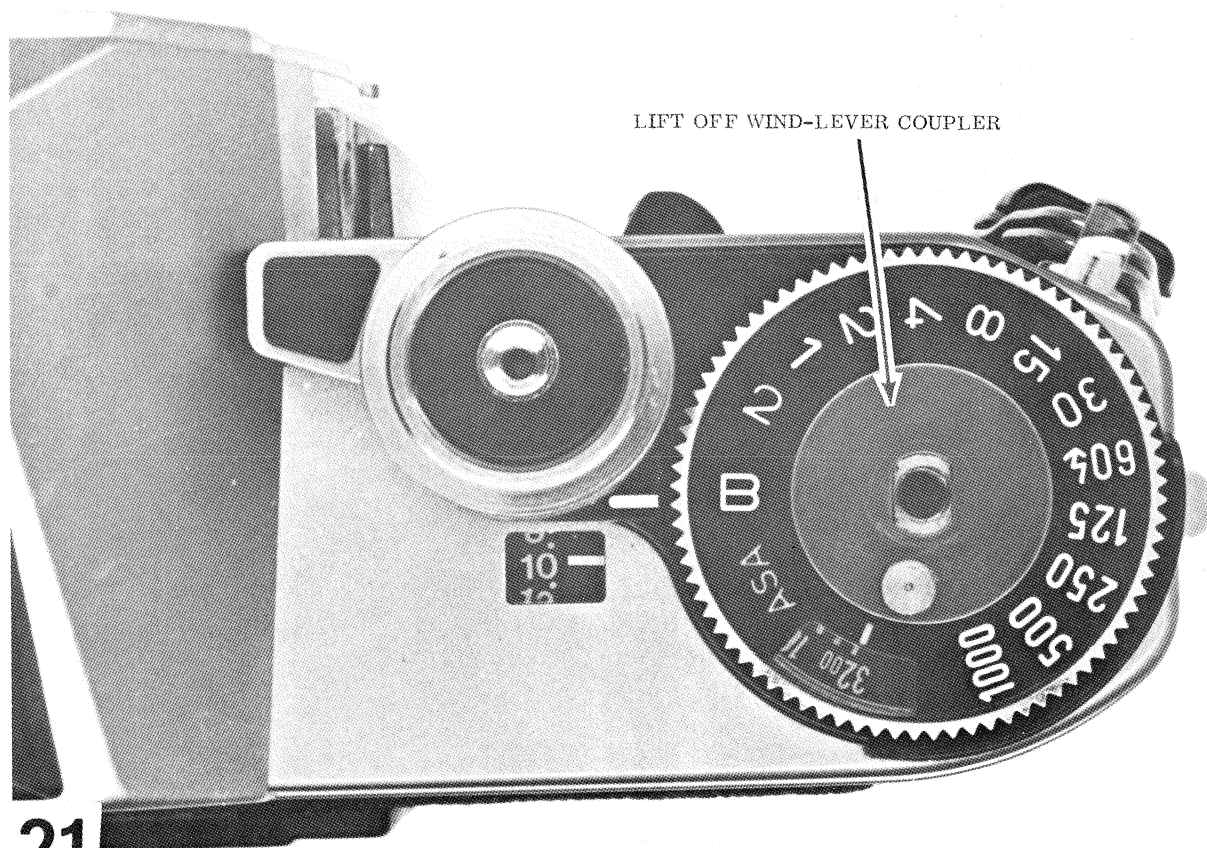
SET SHUTTER SPEED TO "B" AND FILM SPEED TO ASA 3200

FUNCTIONAL RESISTOR

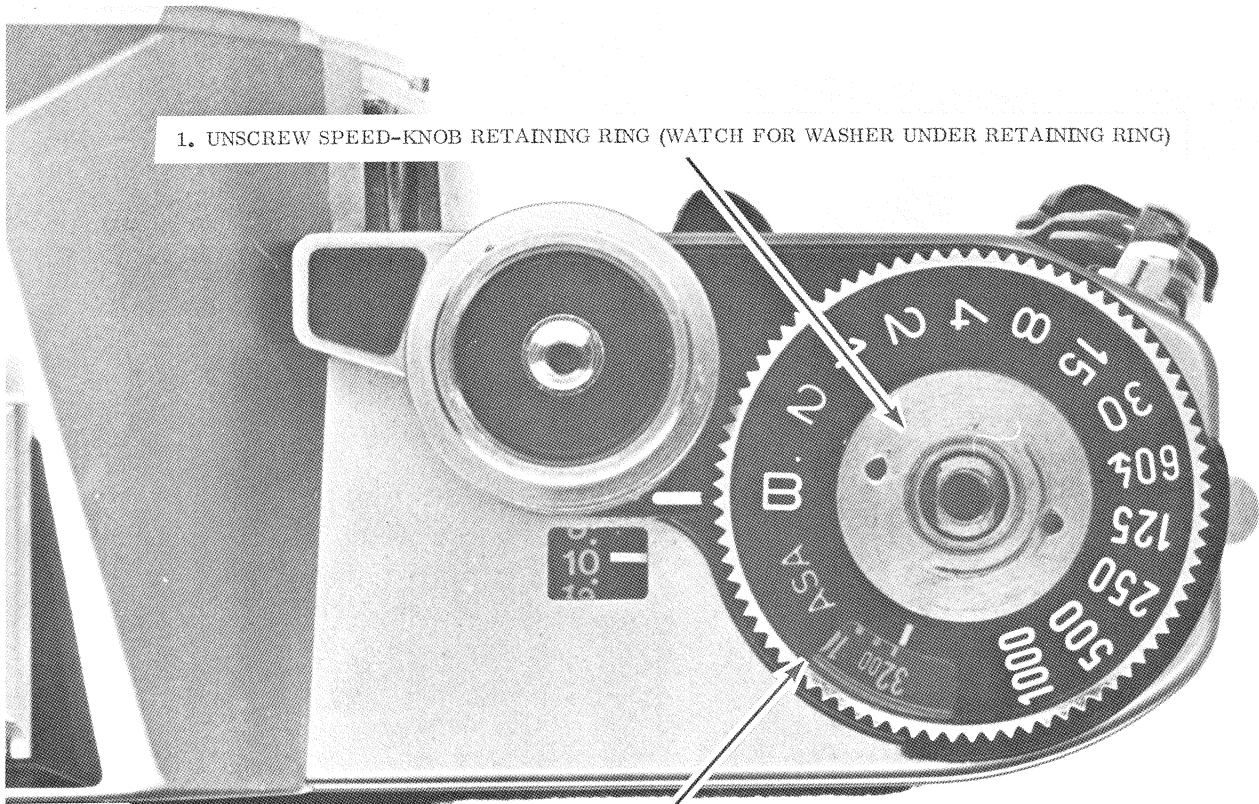


UNSCREW WIND-LEVER COVER
SCREW (WATCH FOR SPRING
WASHER AND TEFLON
WASHER UNDERNEATH)

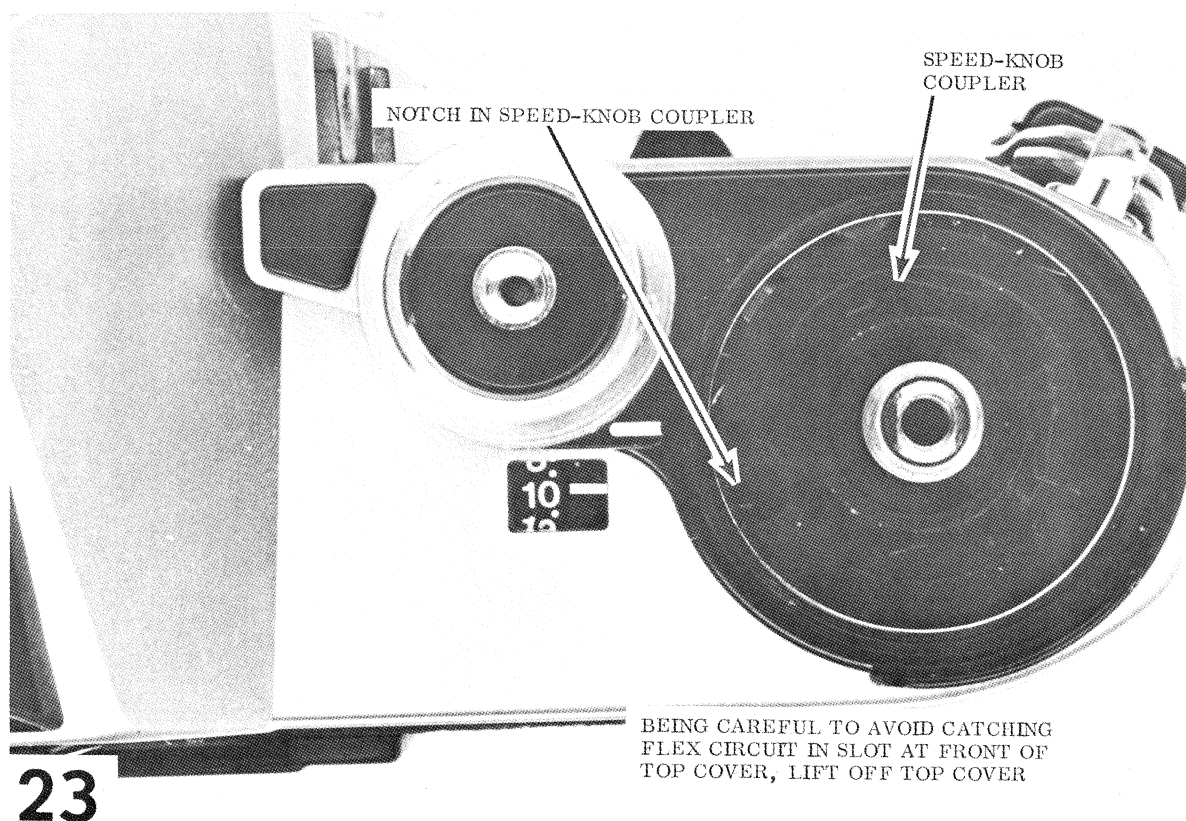




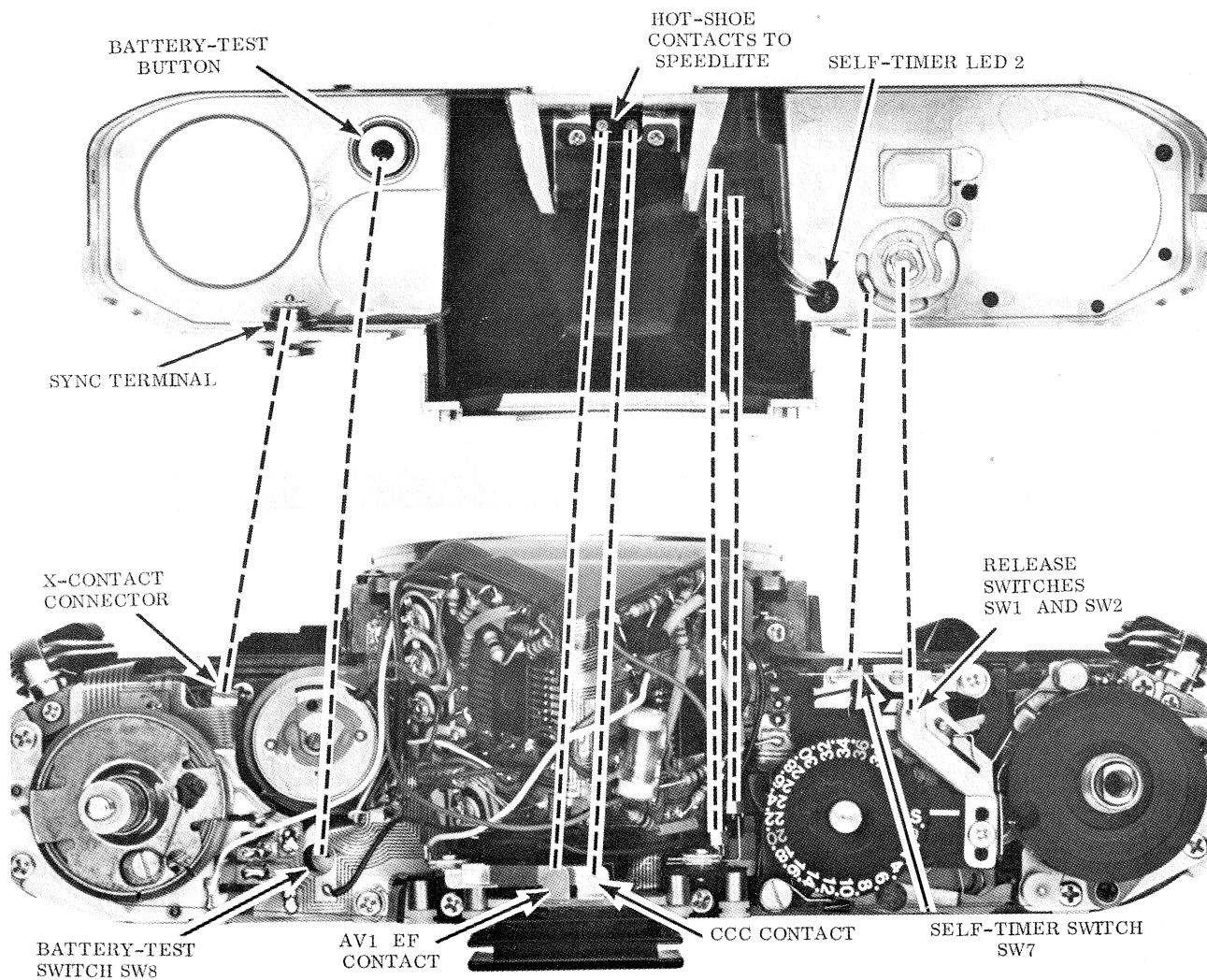
1. UNSCREW SPEED-KNOB RETAINING RING (WATCH FOR WASHER UNDER RETAINING RING)

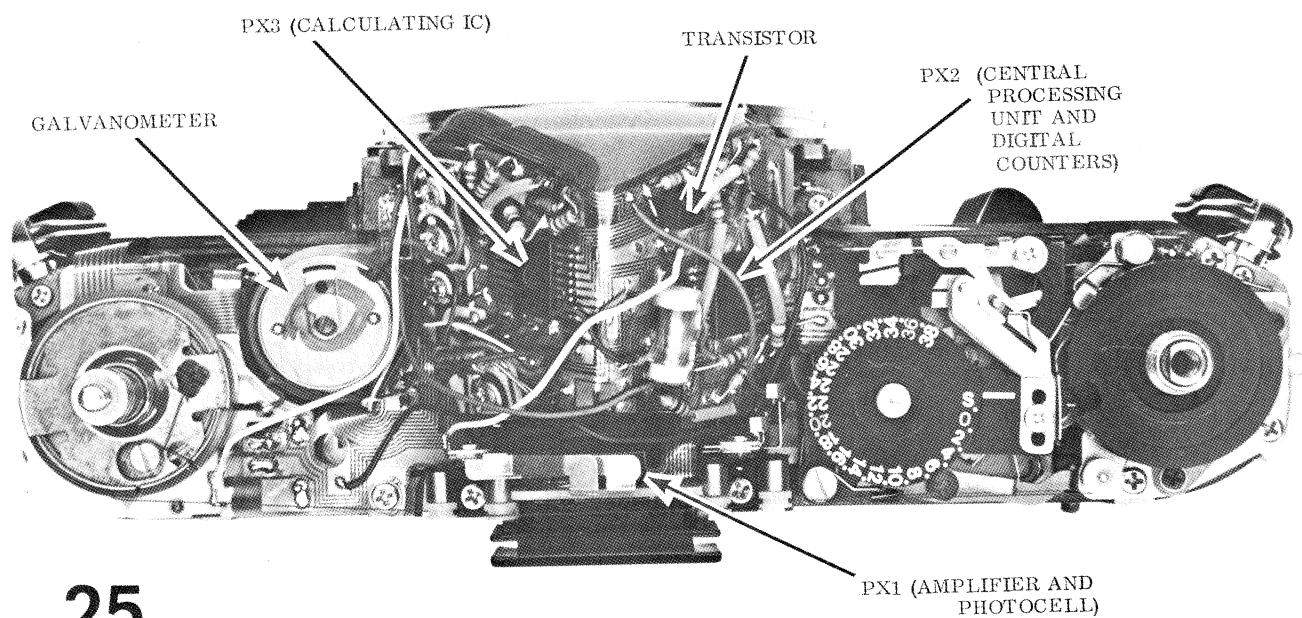


2. LIFT OFF SPEED KNOB

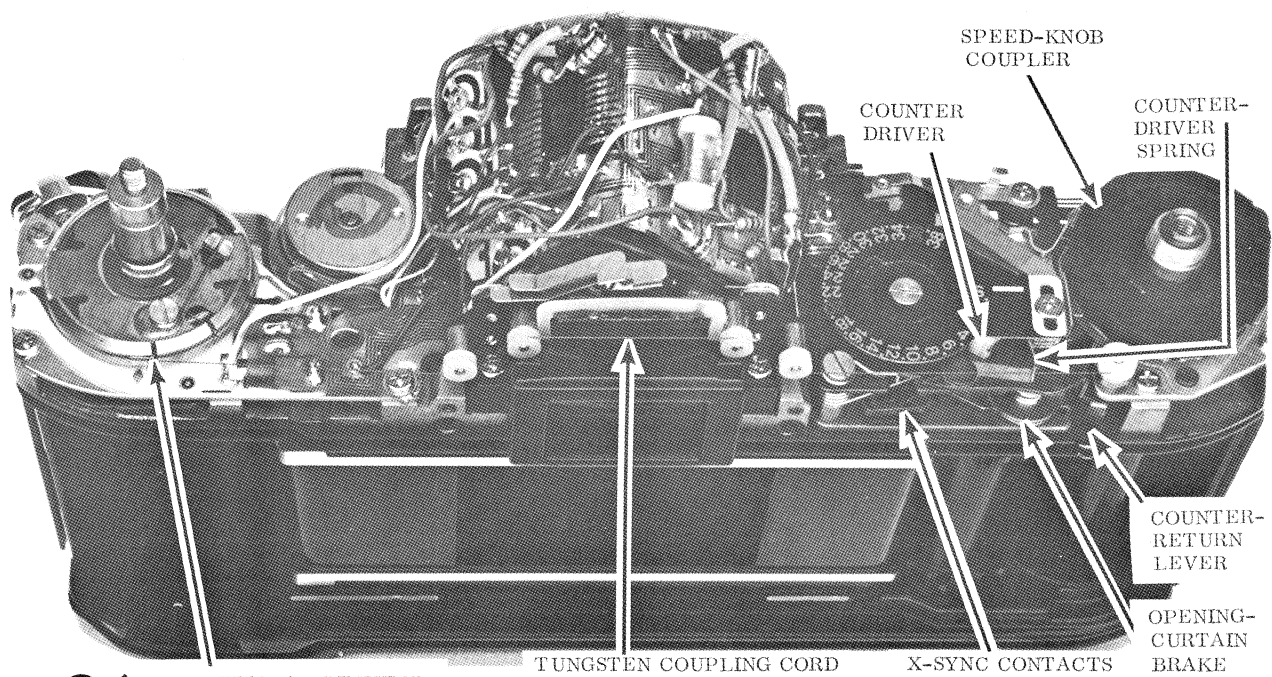


The speed-knob coupler couples the speed knob to the functional resistor. Notice the tab on the underside of the speed knob -- this tab must fit into the notch in the speed-knob coupler. You'll sometimes find that the speed-knob coupler has two notches. In that case, use the notch closer to the front of the camera. To replace the speed knob, place the tab in the coupler notch. Then, turn the speed knob counterclockwise until it drops into place at the "B" position.





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FUNCTIONAL RESISTOR
(SV-TV)

TUNGSTEN COUPLING CORD

X-SYNC CONTACTS

COUNTER
DRIVER

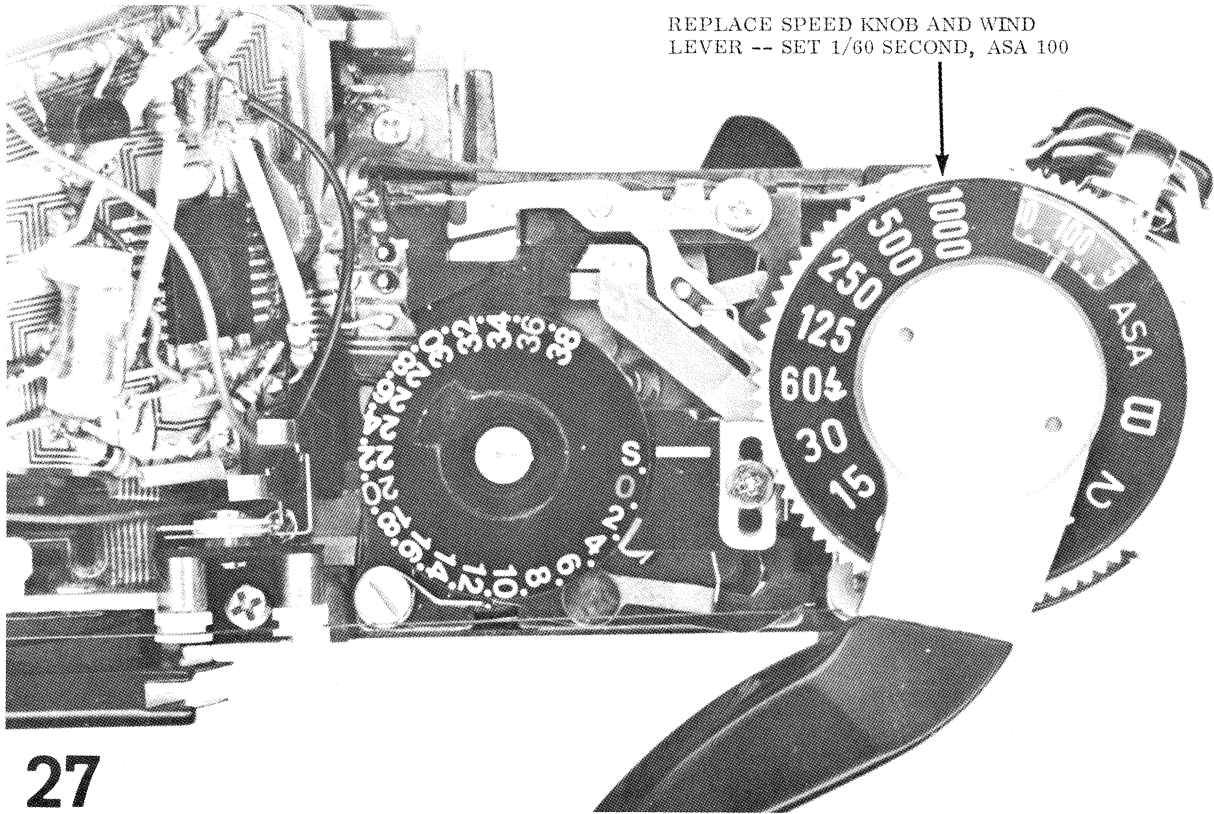
SPEED-KNOB
COUPLER

COUNTER-
DRIVER
SPRING

COUNTER-
RETURN
LEVER

OPENING-
CURTAIN
BRAKE

REPLACE SPEED KNOB AND WIND
LEVER -- SET 1/60 SECOND, ASA 100

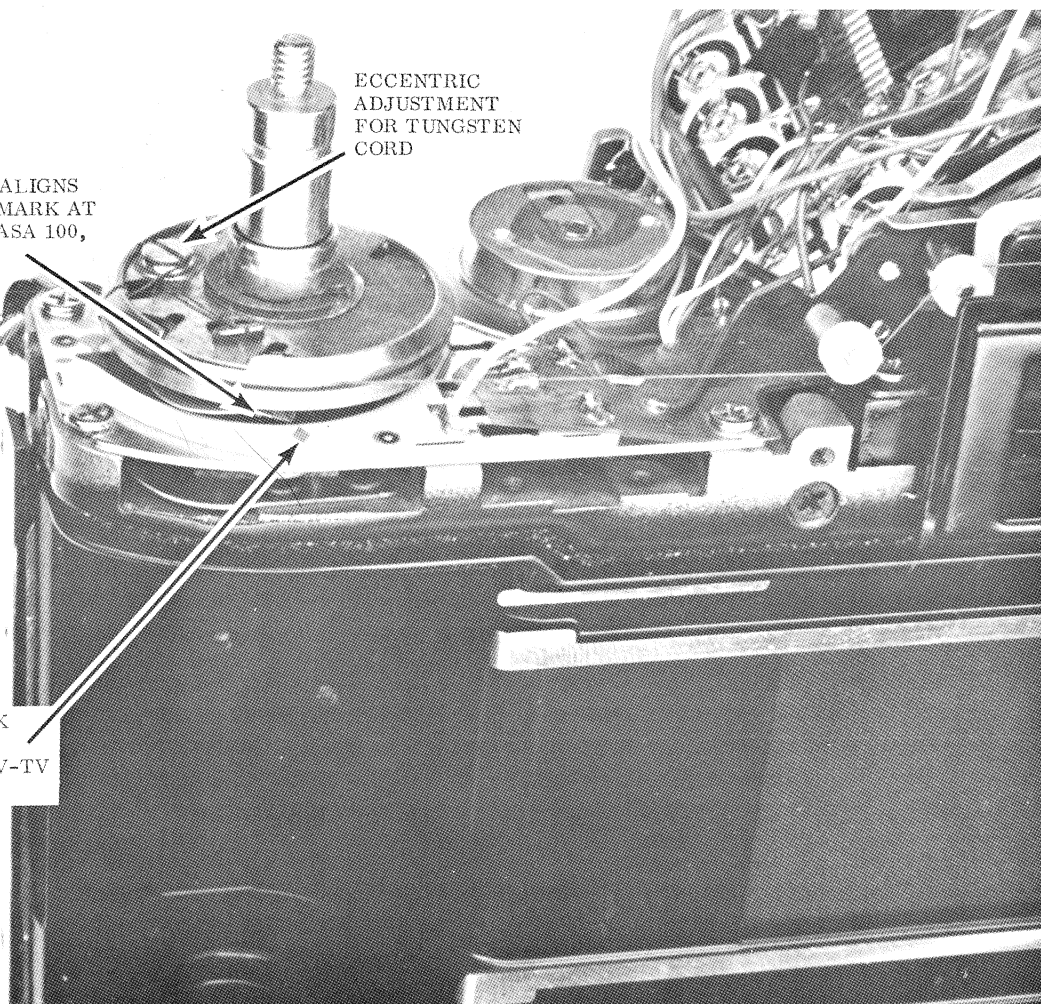


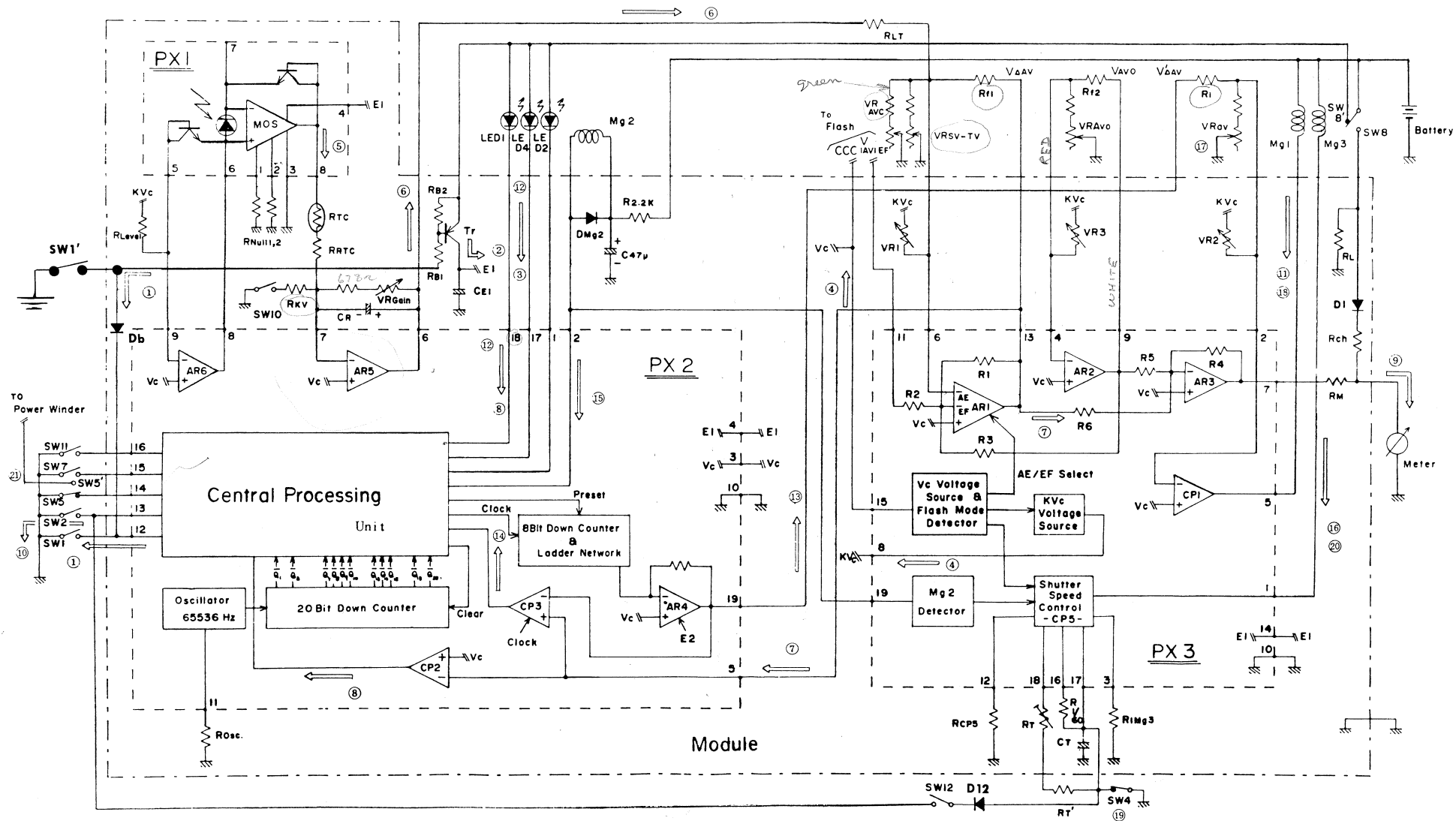
SV-TV BRUSH ALIGNS
WITH TIMING MARK AT
SETTINGS OF ASA 100,
1/60 SECOND

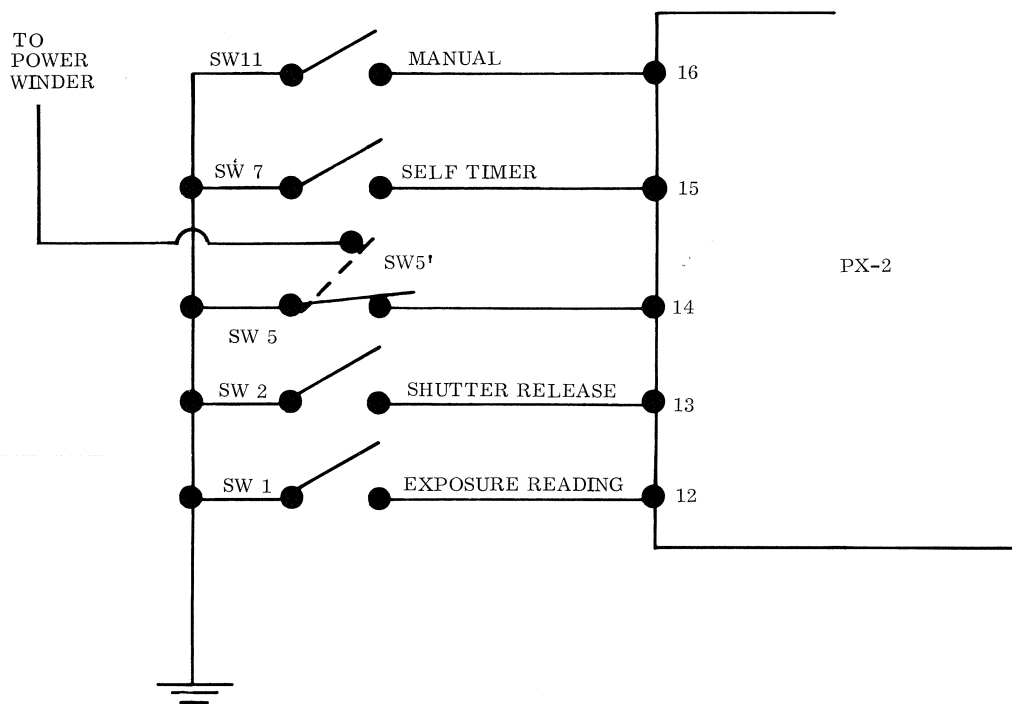
ECCENTRIC
ADJUSTMENT
FOR TUNGSTEN
CORD

TIMING MARK
ON CIRCUIT
BOARD OF SV-TV
RESISTOR

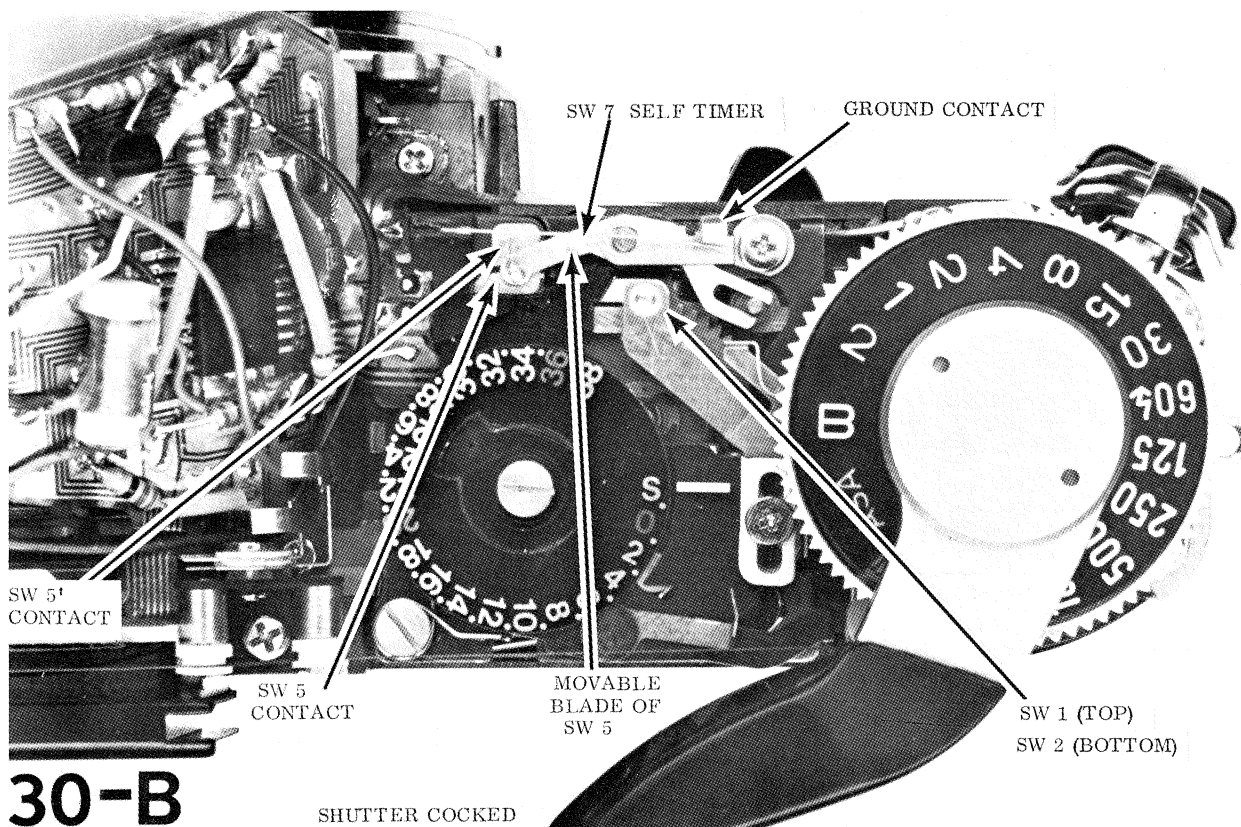
28



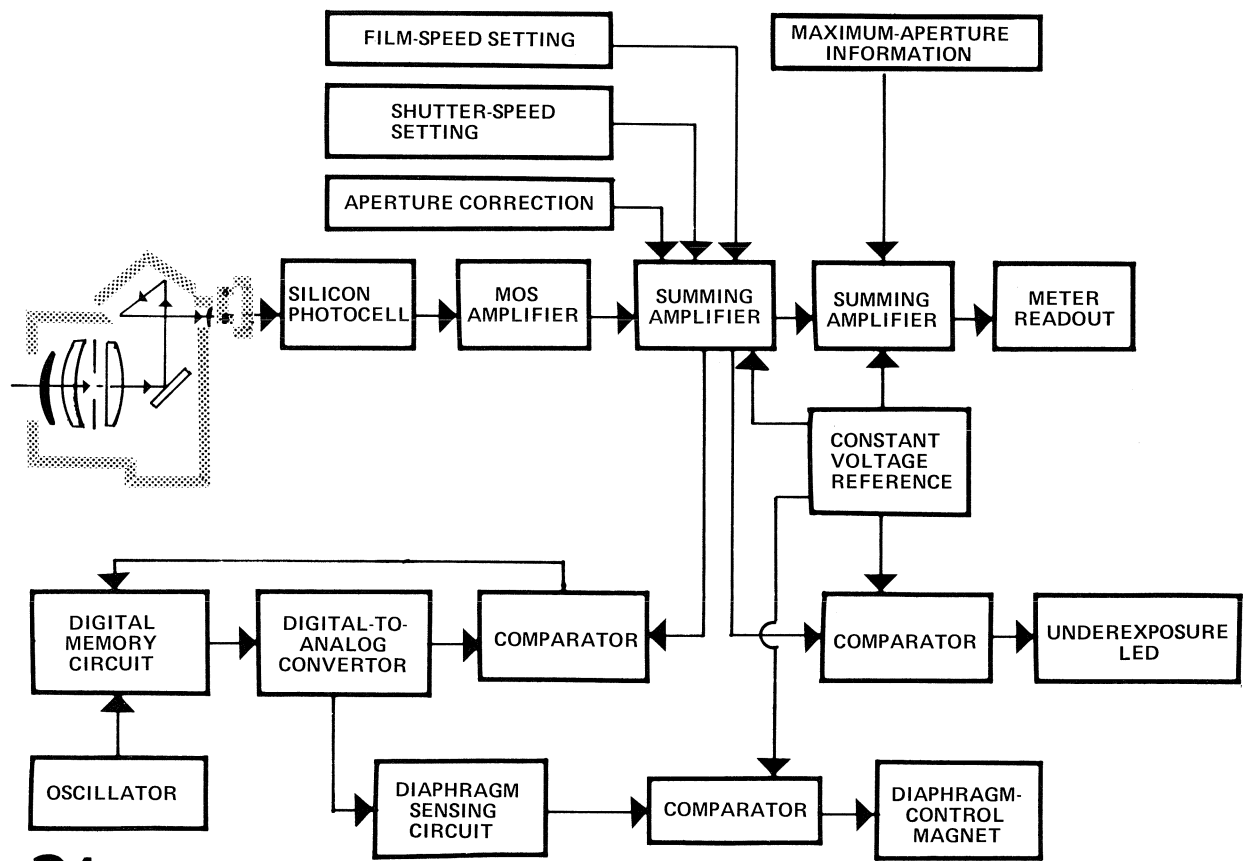


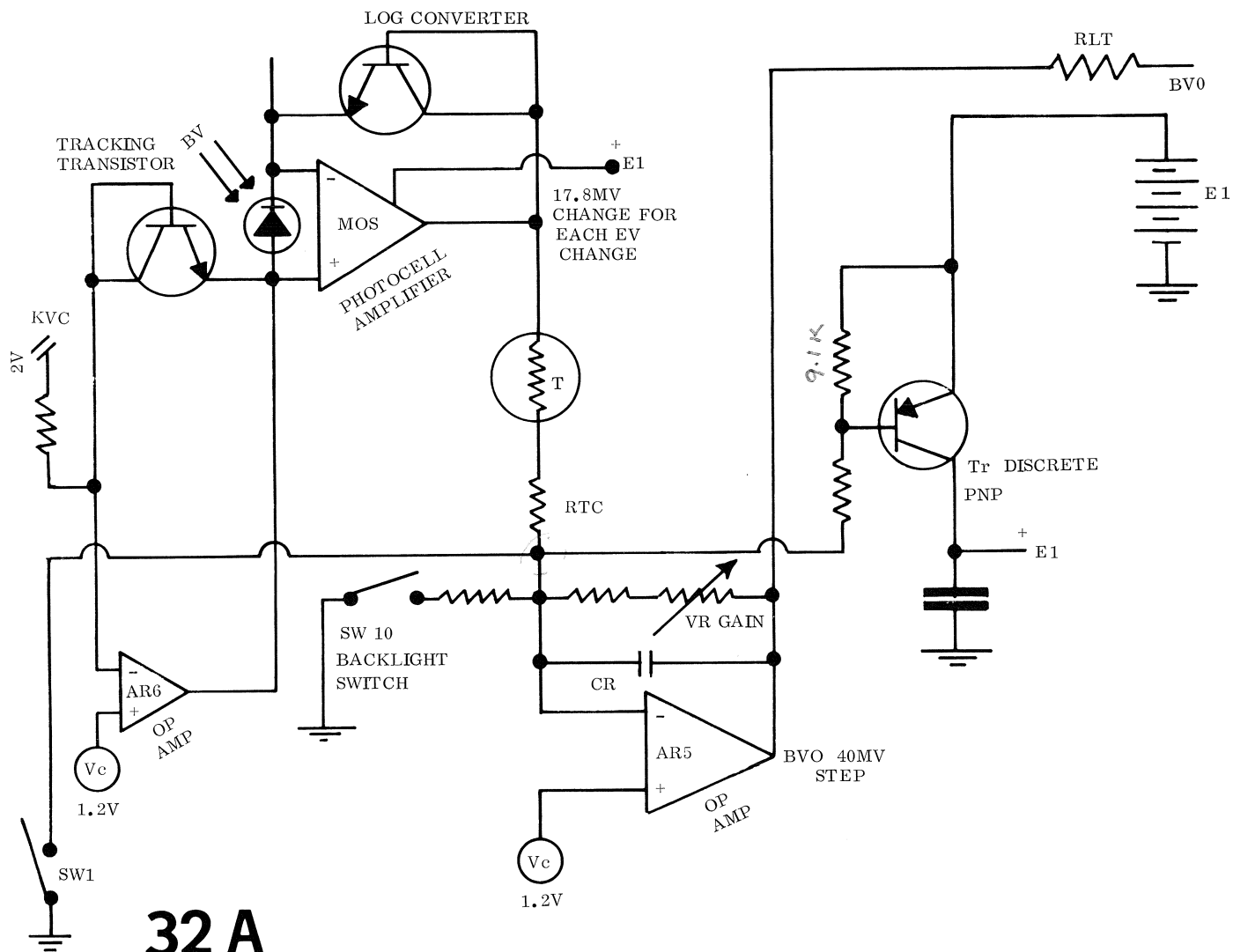


30-A

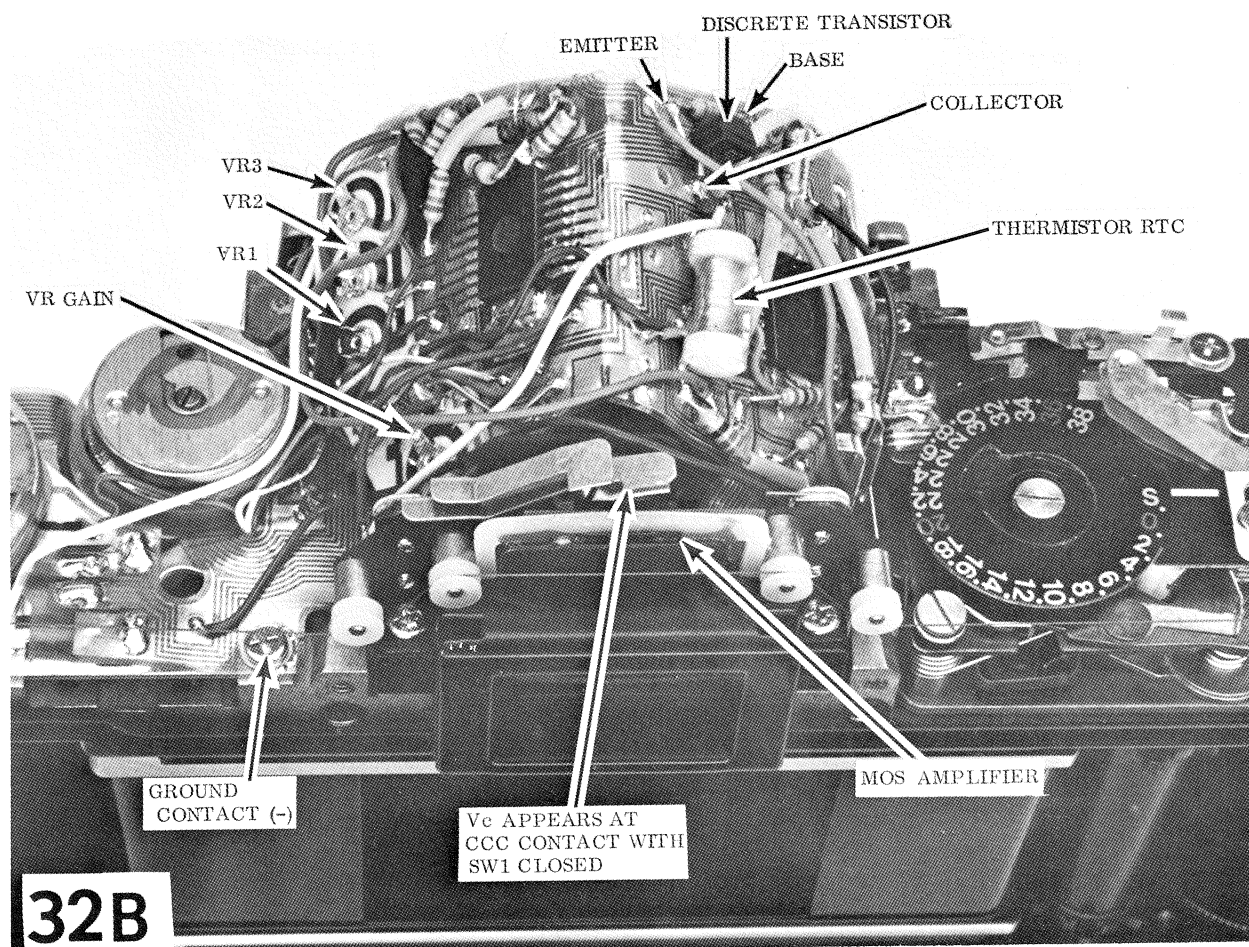


30-B





32 A



32B

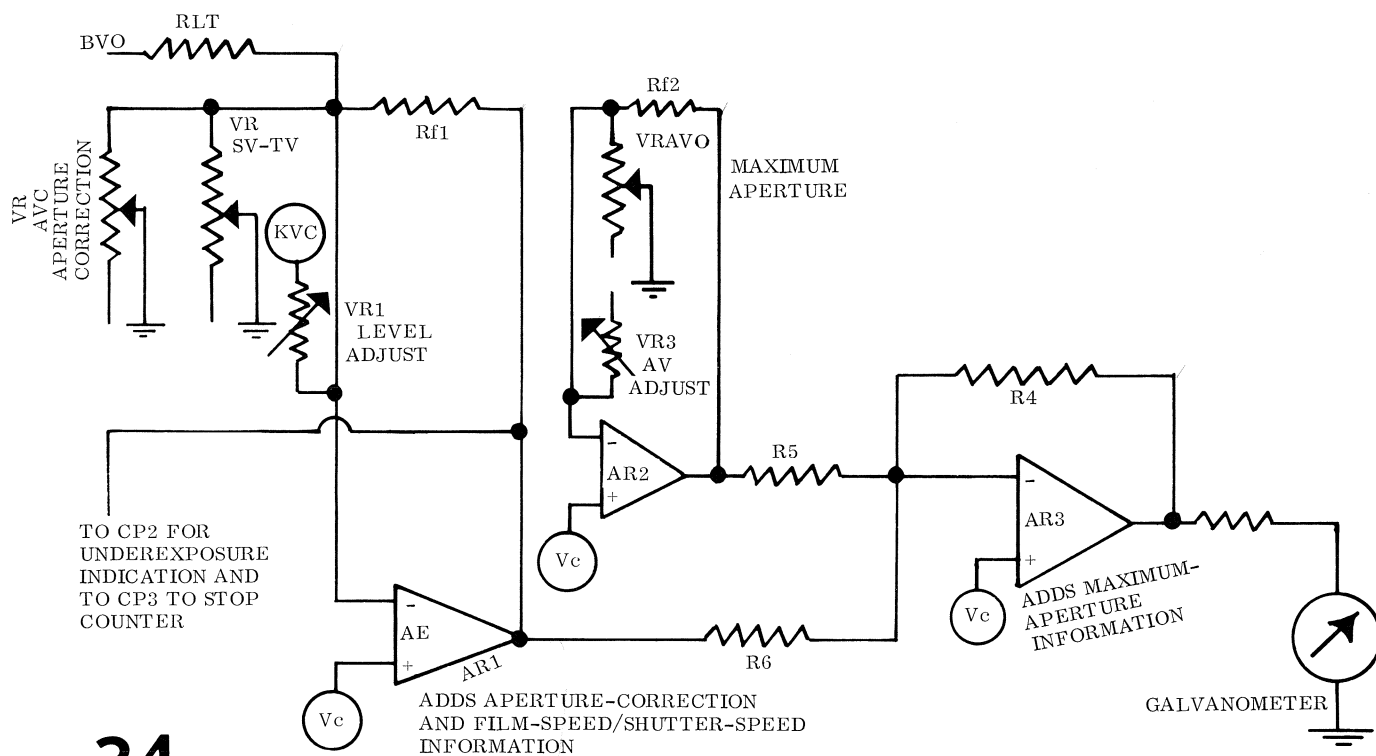
Closing the release-button switch SW1 applies a negative bias to the base of the discrete transistor TR. TR then switches on. So the battery voltage E1 appears at the TR collector. This is the operating voltage applied to each of the three IC's.

Now, the MOS amplifier amplifies the output of the silicon photocell. The transistor between the MOS output and inverting input, connected as a diode, serves as a log converter -- it provides a nonlinear feedback signal. As a result, the MOS amplifies the square root of the input.

A higher light level causes the silicon photocell to apply a more negative signal to the inverting input of the MOS amplifier. So the output of the MOS amplifier goes less negative, or more positive. This amplified output goes to another amplifier -- AR5, which is part of PX 2. AR5 further amplifies the output which goes to the summing resistor RLT. As the output of the MOS goes more positive (higher light level), the output of AR5 goes more negative.

Notice that both AR5 and amplifier AR6 have the precisely regulated reference voltage V_c applied at the noninverting input. This reference voltage, generated within PX3, holds the noninverting inputs constant despite variations in battery voltage. The output of AR6 (pin 8 of PX2) goes to the noninverting input of the MOS (pin 6 of PX1). So AR6 holds the MOS noninverting input constant. The diode-connected transistor that's also hooked to the noninverting input of the MOS tracks changes, such as might be caused by temperature variations.

The feedback circuit for AR5 includes the gain adjustment. The backlight switch SW10 also affects the gain of AR5. When you close the backlight switch, you get an increase in exposure of 1.5 f/stops. Capacitor CR serves as a noise filter to filter out fluctuations that may be present in the light source.



BVO, the brightness value after passing through the lens, now appears at the summing resistor RLT. This voltage goes to the inverting input of amplifier AR1. But there are two other input resistors at the AR1 inverting input -- VR AVC, the aperture correction, and VR SV — TV, the film-speed and shutter-speed information.

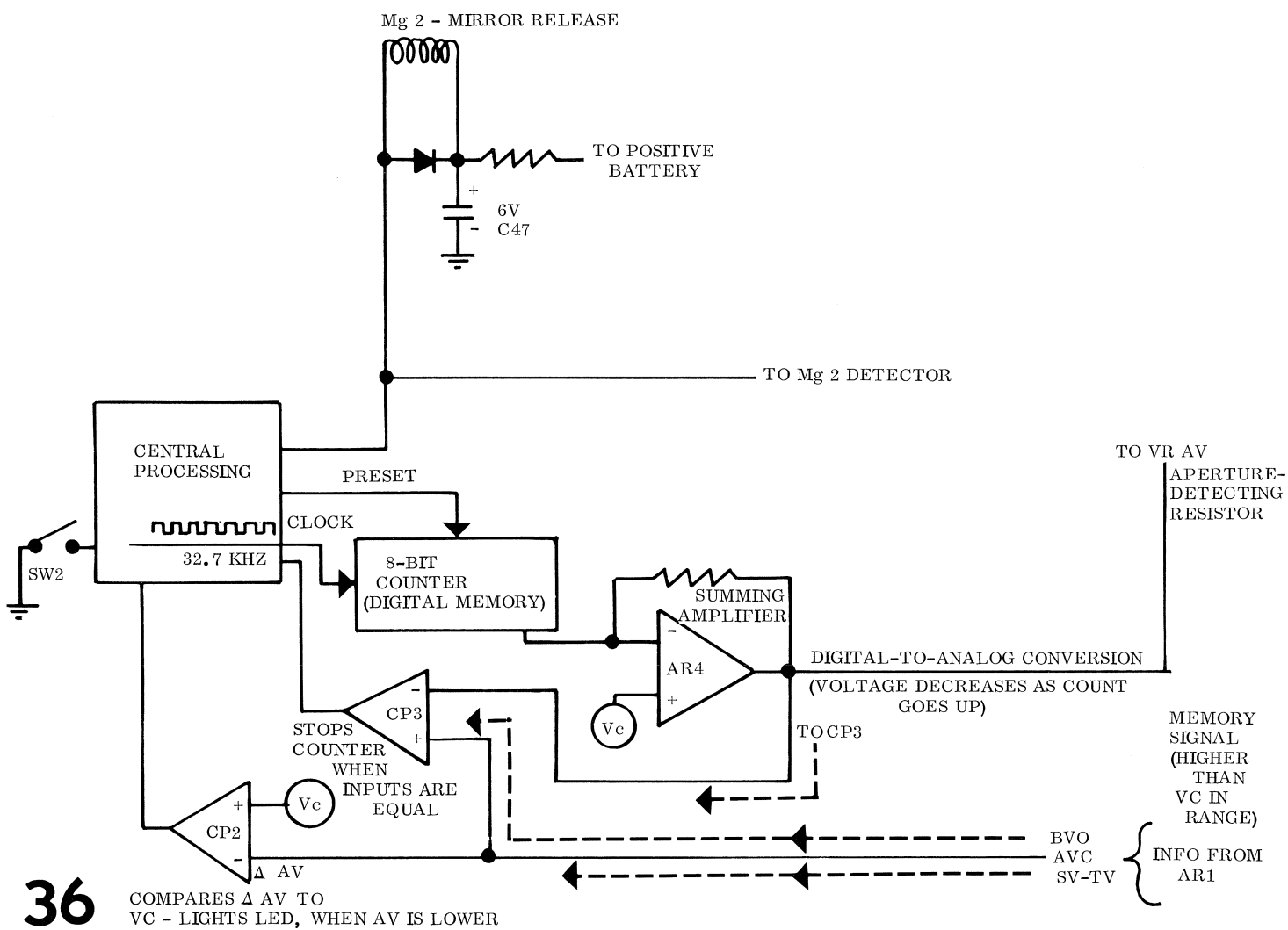
The maximum-aperture post on the back of the lens sets the resistance value of VR AVC. This resistance provides the 0.7 f/stop correction required between f/stops f/2.8 and f/1.2. And the functional resistor, controlled by the speed knob, provides the VR SV — TV information.

With its three input resistors, amplifier AR1 serves as a summing amplifier. It adds the aperture-correction and film-speed/shutter-speed information to BVO. The output of AR1 then goes to the inverting input of AR3, the amplifier that actually drives the galvanometer.

AR3 also serves as a summing amplifier. It adds the output of AR1 to the output of AR2. And the output of AR2 is determined by the maximum aperture of the lens. The maximum-aperture correction pin controls two resistors -- VR AVC (the aperture correction) and VR AVO (the maximum-aperture information).

As the light level striking the photocell increases, the output of AR3 goes down (less positive, or more negative). Consequently, the galvanometer needle doesn't deflect as far. The more the light, the less the needle deflection.

Notice that the maximum-aperture information is added only for the sake of the meter readout -- this information isn't needed by the memory system in determining the actual f/stop to be delivered automatically. So the information sent to the memory circuit comes from the output of AR1.



The digital memory system starts counting when the second release-button switch, SW2, closes. A pulse applied to the preset input of the 8-bit counter clears the counter. A clock signal of 32.7 KHz then feeds the second input of the 8-bit counter. And the 8-bit counter starts counting. The output of the 8-bit counter goes to the inverting input of amplifier AR4. AR4 turns the count to an analog voltage which decreases as the count increases.

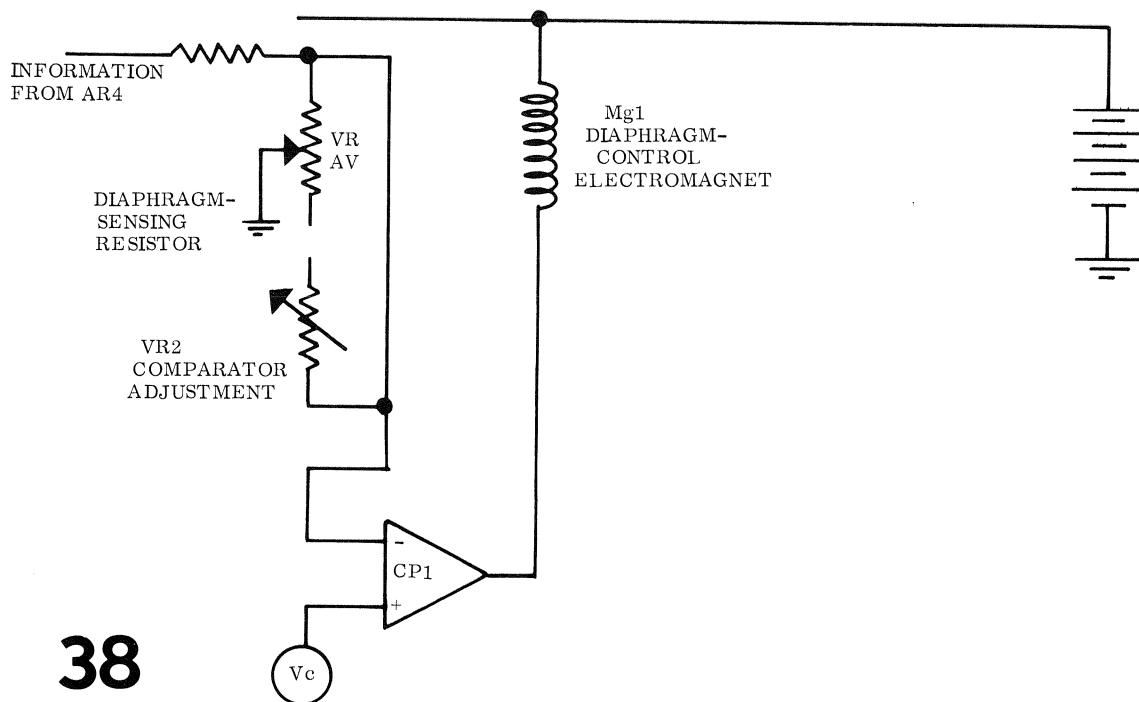
The output of AR4 then goes to one of the inputs of comparator CP3. The other input of CP3 comes from the output of AR1, the summing amplifier for the brightness value, the aperture correction, the shutter speed, and the film speed. When the two inputs are equal, CP3 shuts off the counter. The 8-bit counter stays at this count as long as it has operating power.

A 10ms time delay provided by the central processing unit gives the digital counter more than enough time to reach its maximum count. After this time delay, capacitor C47 discharges through the coil of the combination magnet Mg2. And Mg2 releases the mirror. Now, the photocell can no longer see the light coming through the lens. But it doesn't matter -- the information is stored in the 8-bit counter.

The current flow through the Mg2 coil simultaneously energizes the closing-curtain electromagnet Mg3. An output taken from the Mg2 coil circuit goes to the Mg2 detector. So Mg3 draws no current until the mirror releases.

Besides going to CP3, the information from AR1 goes to another comparator -- CP2. CP2 compares the information from AR1 with the reference voltage V_c . As the light level decreases, the AR1 output goes down -- less positive. When the AR1 output goes less positive than the reference voltage V_c , comparator CP2 turns on LED1. That provides the underexposure warning.

A second output from AR4 goes to the diaphragm-sensing resistor VRav. Here's where the voltage stored in the memory circuit decides the actual diaphragm opening -- how far the lens stops down automatically.

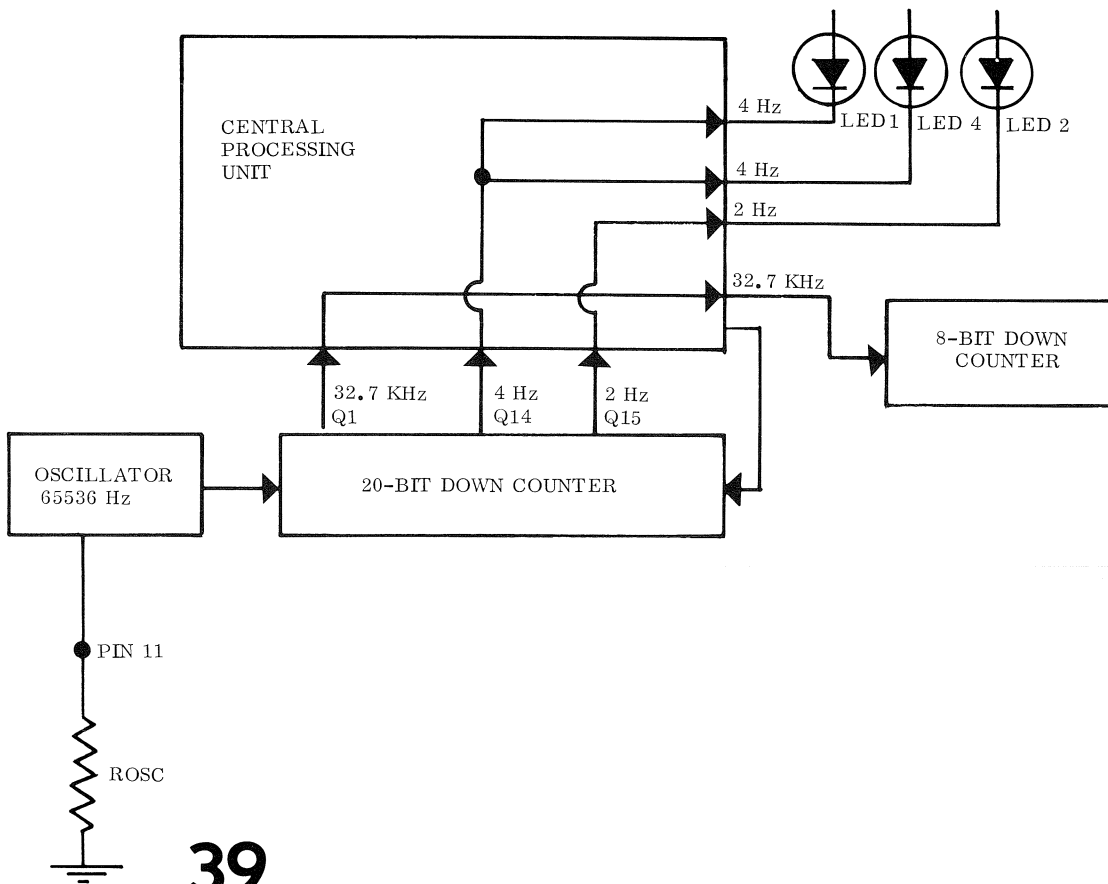


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The memory information from AR4 goes to comparator CP1. This information is added to the information provided by the diaphragm-sensing resistor VR AV. As long as the output of CP1 is low, current can flow through the diaphragm-control electromagnet Mg1 -- CP1 then effectively supplies a connection between Mg1 and ground to sustain current flow.

As the diaphragm closes, though, the wiper on the diaphragm-sensing resistor moves down. That brings the inverting input of CP1 closer to ground. When the voltage inputs to CP1 are equal, CP1 shuts off. Now, there's no longer a current flow through Mg1. So Mg1 releases its armature to arrest the diaphragm.

VR2, the comparator adjustment, provides your adjustment point for the actual diaphragm opening.



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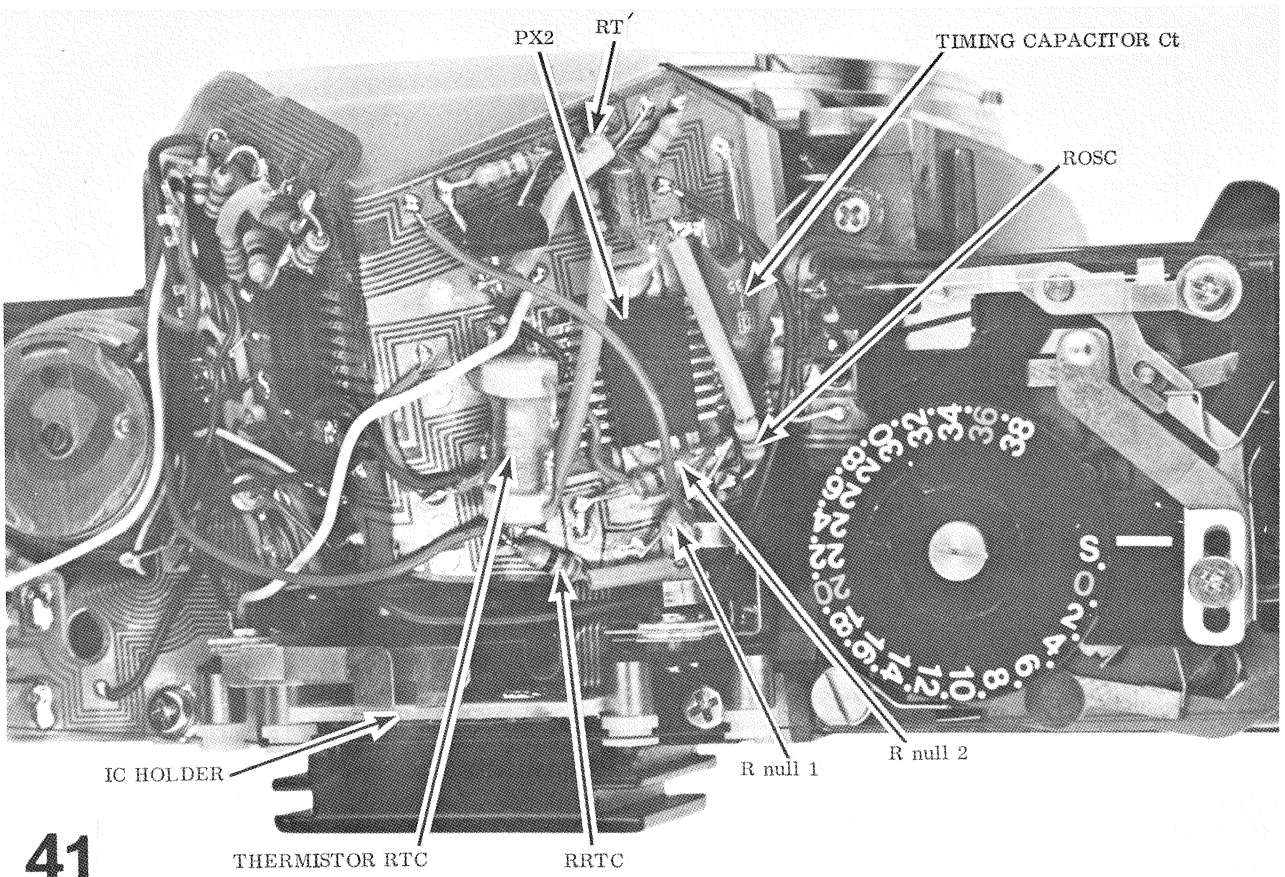
The oscillator within PX2 supplies a 65536 Hz. signal to the 20-bit down counter. The 20-bit down counter then cuts the frequency in half at each of its 20 bits. So, at the first bit, the 20-bit down counter supplies the 32768 frequency for the 8-bit counter. At the fourteenth bit, there's the 4 Hz. signal for the two warning LED's, LED 1 and LED 4. And at the fifteenth bit, you have the 2 Hz. signal for the self-timer LED, LED 2.

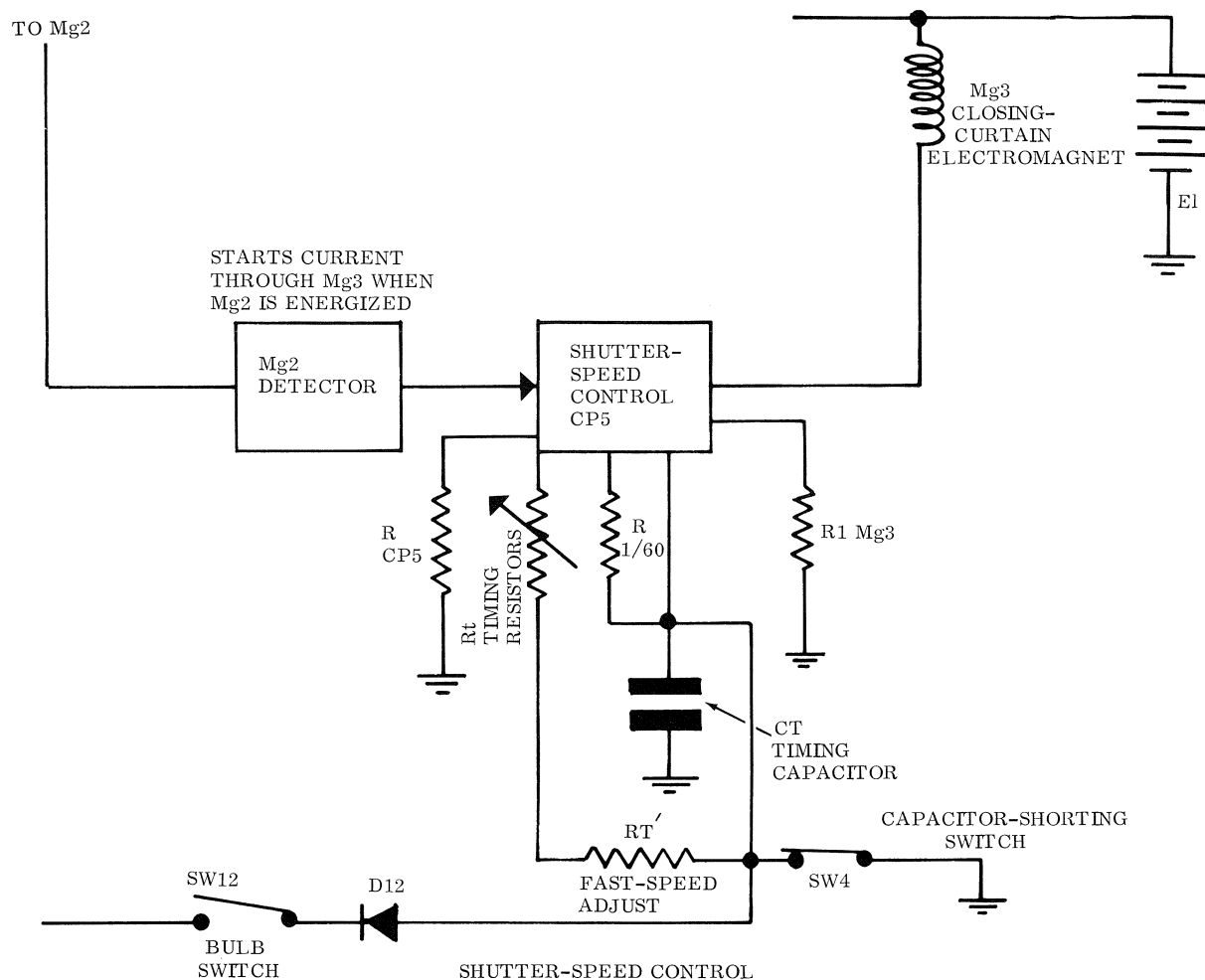
A discrete resistor Rosc controls the frequency of the oscillator. Rosc hooks between ground and pin 11 of PX 2. If you replace PX2, you can check the frequency of the oscillator by counting the number of flashes of the self-timer LED -- it should flash exactly 20 times. Also, you can time the self-timer operation -- it should be within 8 to 12 seconds. If the oscillator frequency is incorrect, change resistor Rosc. A higher resistance increases the self-timer delay time.



Short the output of the amplifier to the inverting input -- pin 8 to pin 7. And measure the voltage between the output (pin 8) and the noninverting input (pin 6). When you close SW1, you should measure 0 volt + 5 mV.

If you have a reading of more than 5 mV, remove the larger of the two null resistors. And connect a 30K variable resistor in its place. Adjust the variable resistor until the voltage reading between pins 6 and 8 is 5mV or less. Then, measure the resistance of the variable resistor. Install a fixed resistor of the same value. If you can't bring in the adjustment using the larger of the two null resistors, follow the same procedure to find the proper value for the smaller null resistor.

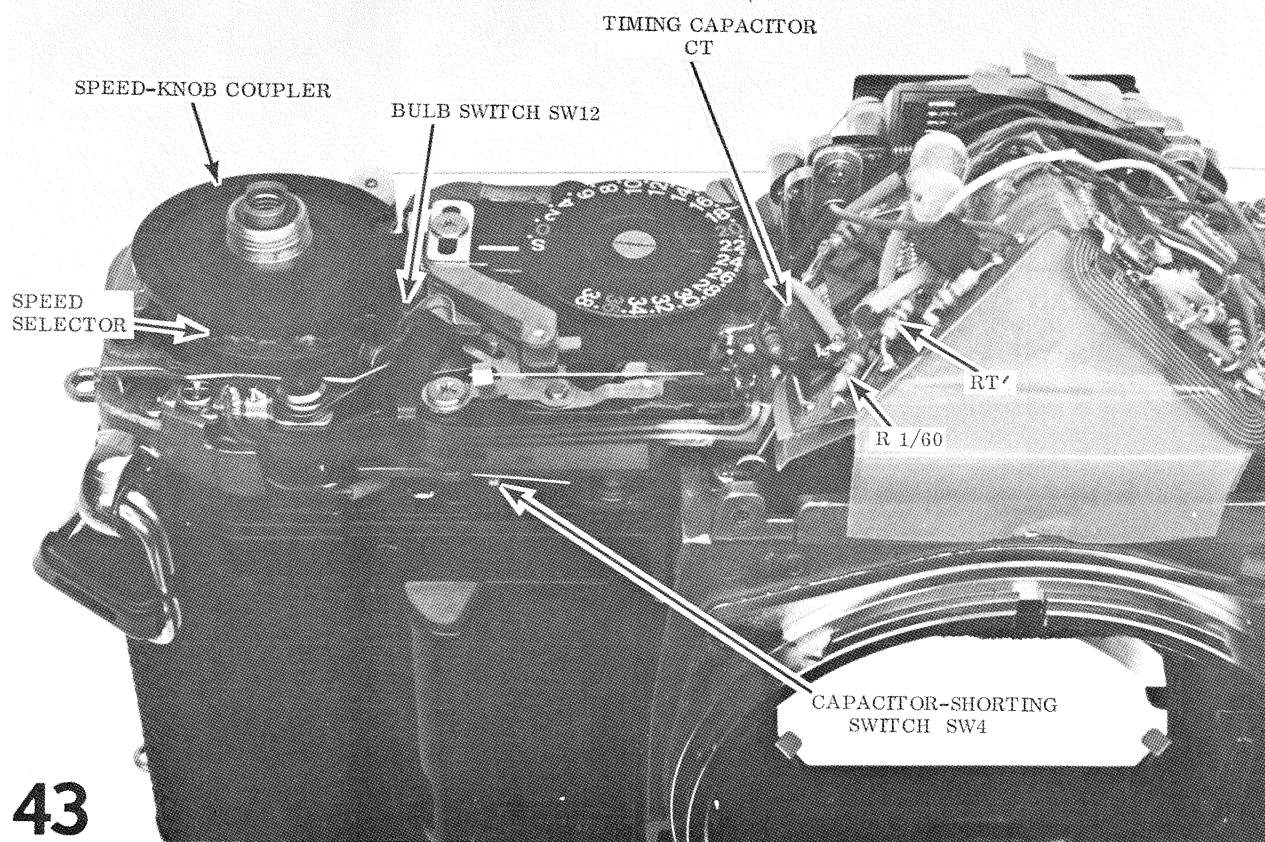


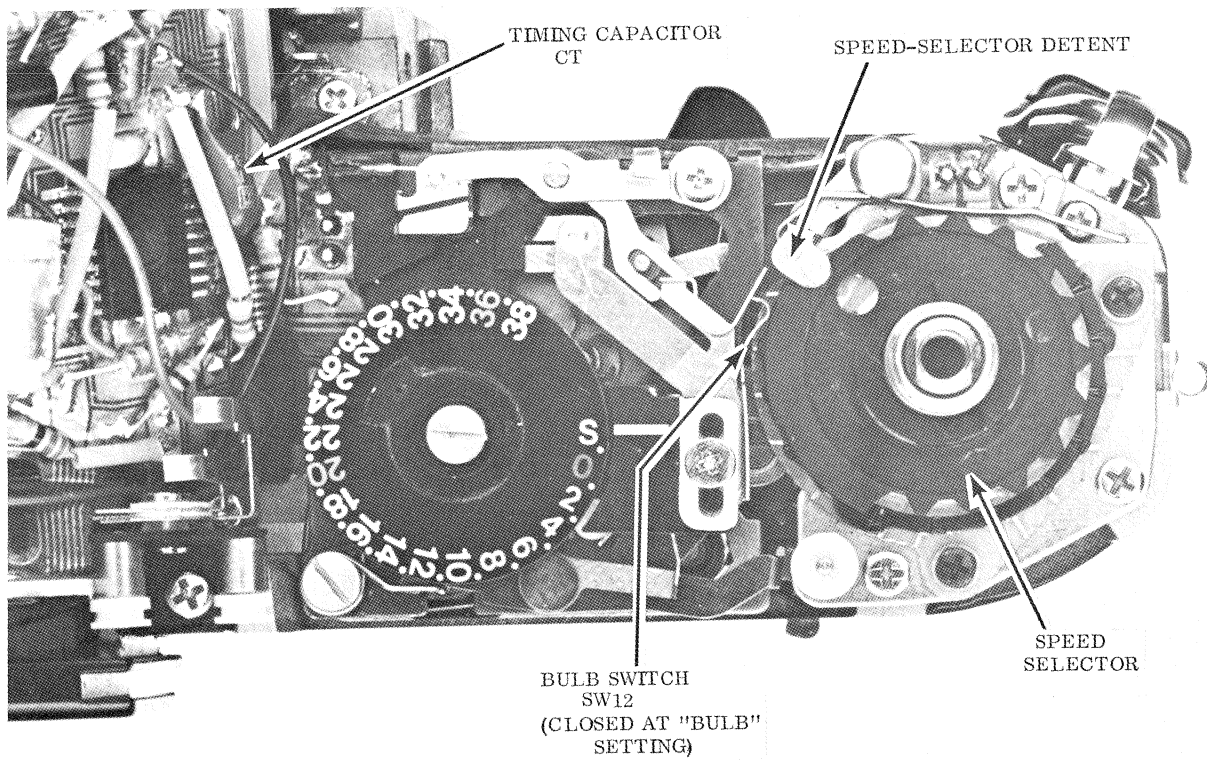


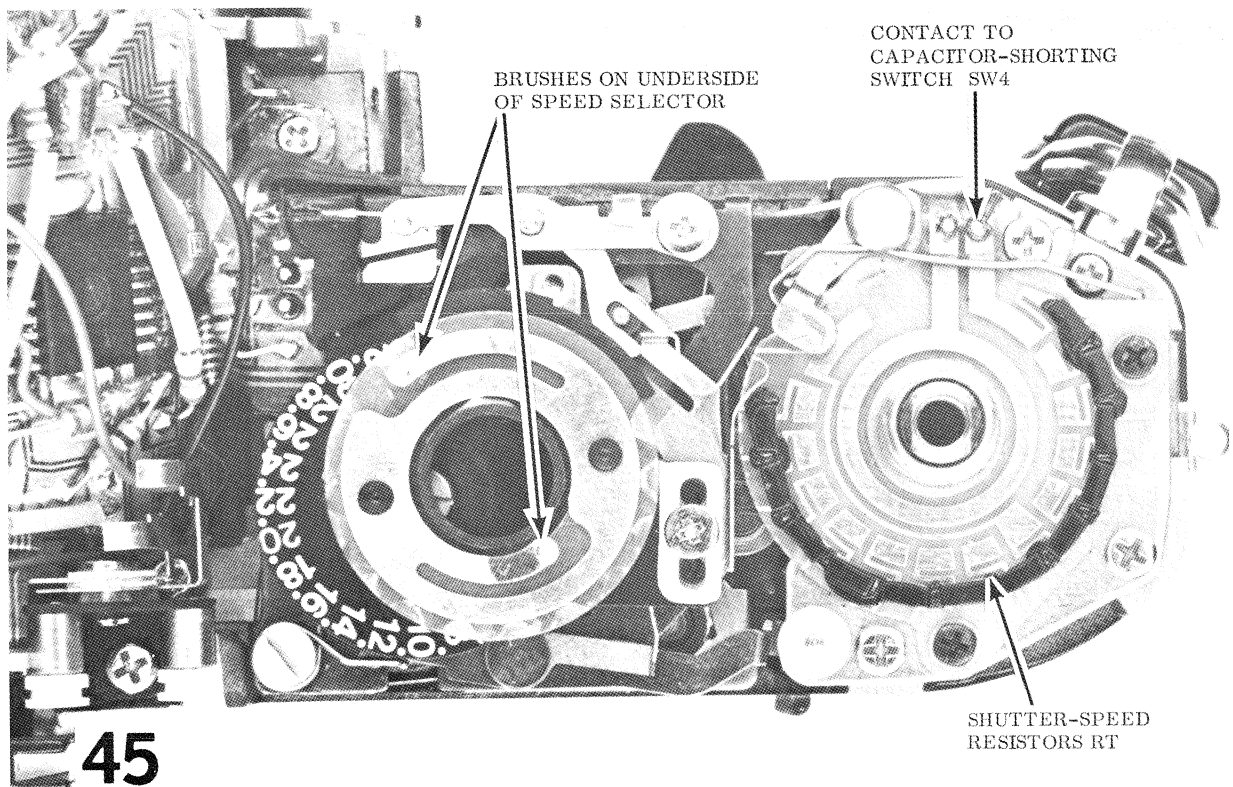
42

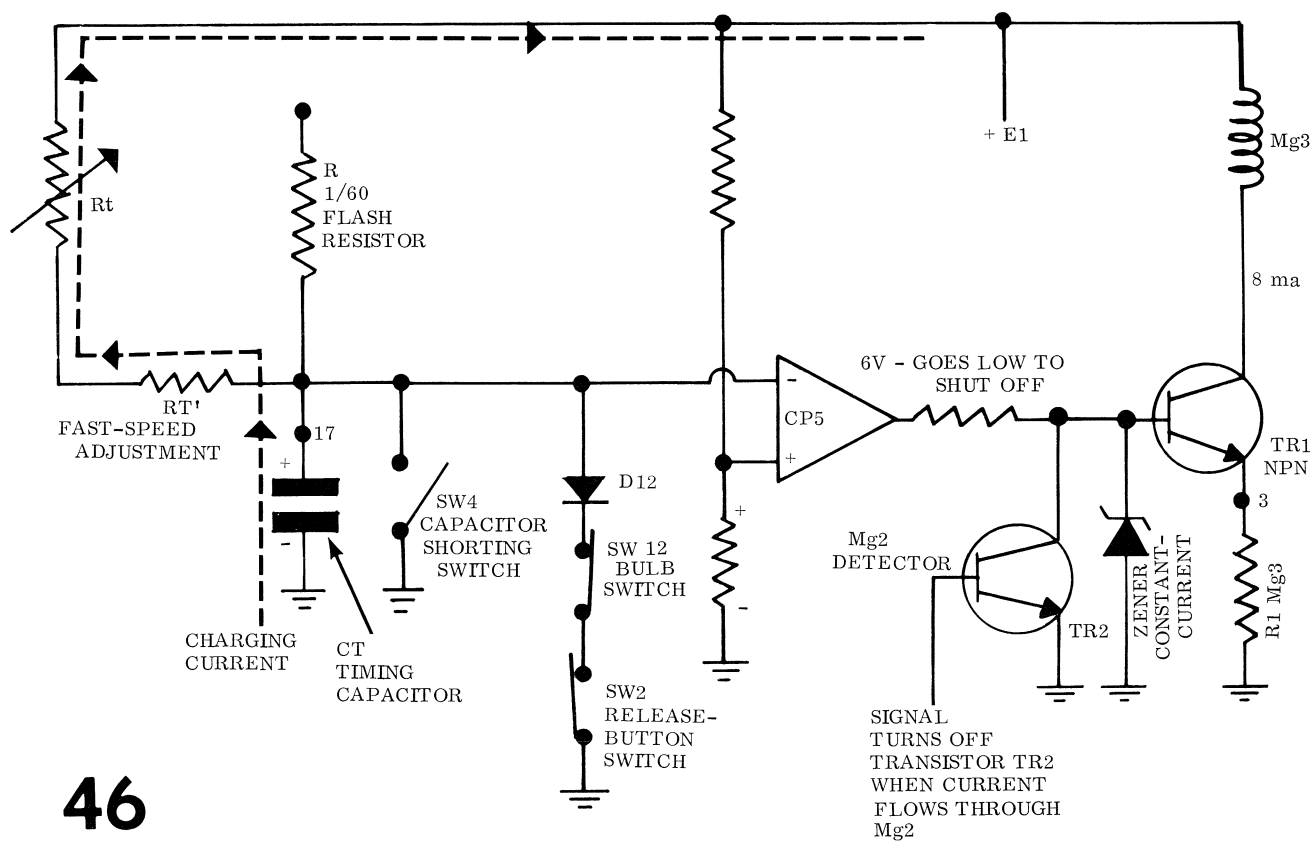
The Mg2 detector senses when the current flows through the Mg1 coil. It then turns on the shutter-speed control circuit to energize the closing-curtain electromagnet Mg3. When the opening curtain releases, the opening-curtain latch opens the capacitor-shortening switch SW4. Now, the timing capacitor CT starts charging through the resistance of RT, selected by the speed-knob setting. When the timing capacitor reaches the proper voltage, it shuts off the comparator CP5. And CP5 shuts off the current flowing through the closing-curtain electromagnet Mg3.

NOTE: SPEED KNOB HAS BEEN REMOVED TO POINT OUT PARTS









Here, the shutter-speed control circuit has been redrawn with more detail to show the operation. Transistor TR2 (within PX3) serves as the Mg2 detector. TR2 switches on when release-button switch SW2 closes to short between the base of TR1 and ground. So, without base bias, TR1 can't turn on. And no current flows through the closing-curtain electromagnet Mg3.

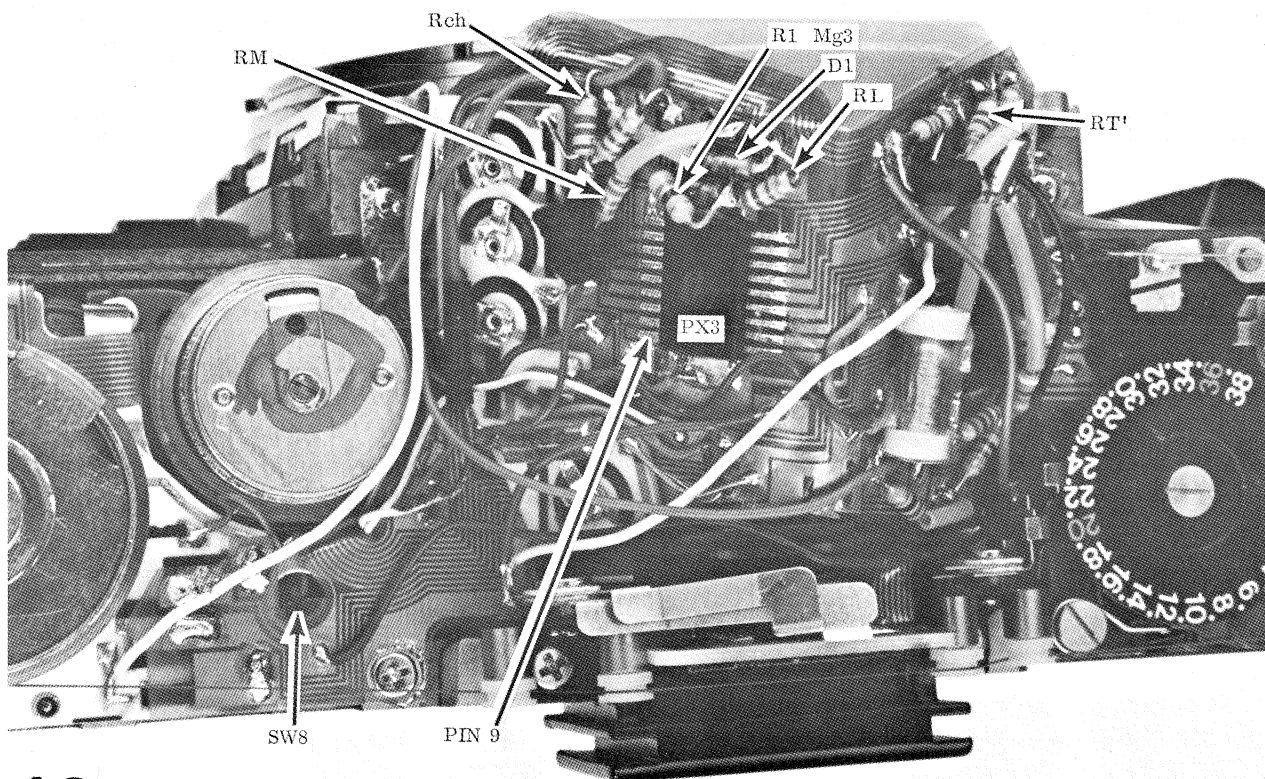
But current flowing through the coil of Mg²₁ applies a negative signal to the base of TR2. Consequently, TR2 switches off. The high collector voltage of TR2 now applies the forward bias to turn on TR1 and energize the closing-curtain electromagnet. The zener diode hooked to the base of TR1 maintains a constant base bias. So TR1 maintains a constant current of 8 ma through the coil of Mg3.

Opening the capacitor-shortening switch SW4 allows the timing capacitor CT to charge through the shutter-speed resistors. As the timing capacitor CT charges, it applies an increasingly positive signal to the inverting input of comparator CP5. The output of CP5 then goes less positive, finally going low enough to shut off TR1. That shuts off the current flow through Mg3 to release the closing curtain. The slower the shutter speed you select, the longer it takes CT to charge sufficiently.

Notice that the capacitor-charging current also flows through resistor RT'. So resistor RT' provides one of your shutter-speed adjustments. Changing the resistance of RT' has the greatest effect on the fast speeds. One adjustment procedure is to first check 1/2 second. If the 1/2-second exposure is too fast (less than 476 ms), hook a 0.1 microfarad capacitor in parallel with CT. That increases the capacitance of CT, meaning it takes longer for the timing capacitor to charge.

If the 1/2-second exposure is too slow (more than 525 ms), hook a 100K variable resistor across CT. Adjust the variable resistor until the shutter speed is within tolerance. Then, replace the variable resistor with a fixed resistor of the same value. Next, test the shutter at 1/1000 second. And replace RT' to bring in the shutter speed. If the shutter speed is too fast, use a larger resistance value to slow down the capacitor-charging time.

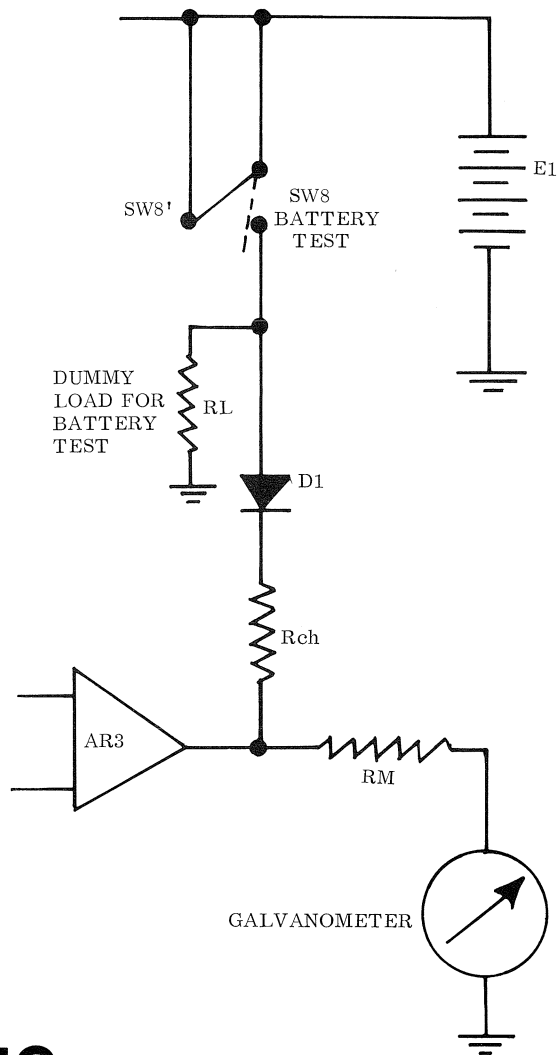
On bulb operation, the speed selector closes the bulb switch SW12. Now, the effect is the same as when the capacitor-shortening switch is closed -- the timing capacitor CT can't charge sufficiently to shut off the electromagnet current. As long as you hold the release button down, switch SW2 remains closed. And the timing capacitor can only charge to the voltage dropped across D12. Letting up the release button allows SW2 to open. That allows the timing capacitor to charge through the flash resistor R 1/60. R 1/60 also provides the charging path when you're using the Speedlite .155A to automatically program the 1/60-second exposure.



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If you replace the complete flex circuit, the replacement board comes without resistor Rch (for the battery test) and resistor RT' (for the shutter-speed adjustment). The battery-test adjustment is described under the adjustment section at the end of the Workbook.

If you replace PX3, check the current through the closing-curtain electromagnet Mg3. Disconnect one of the electromagnet's leads and hook a digital ammeter in series with the coil. Then, hold open the shutter on bulb. You should measure a current of 8ma \pm 10%. If the current is incorrect, replace resistor R1Mg3 with a different value.



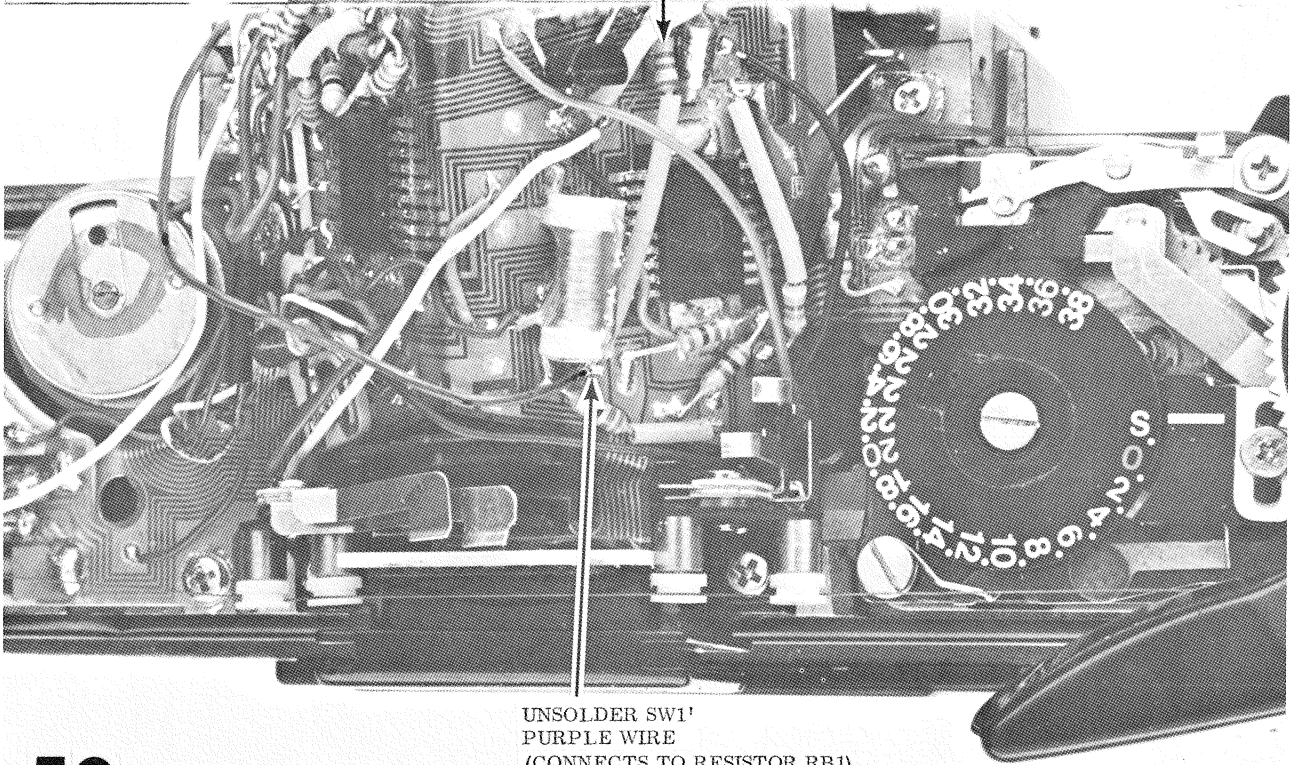
49

Pushing the battery-test switch moves SW8 to the dashed-line position. That removes power from the rest of the circuit. And it simultaneously applies power to the battery-test circuit. Battery current now flows through the galvanometer, Rch, and D1. Resistor RL serves as a dummy load for the battery-test circuit. And diode D1 prevents RL from drawing current in normal operation when the output of AR3 goes high.

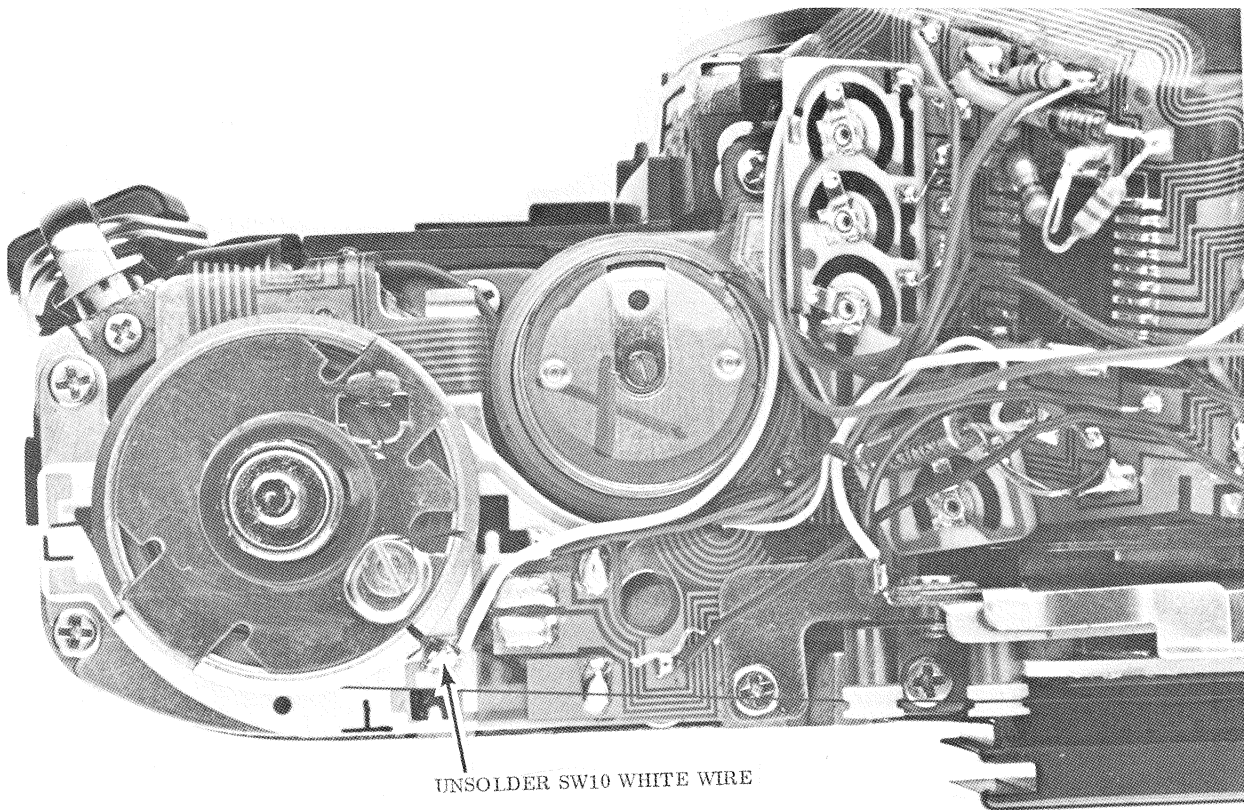
FRONT-PLATE/
MIRROR-CAGE REMOVAL

RB1

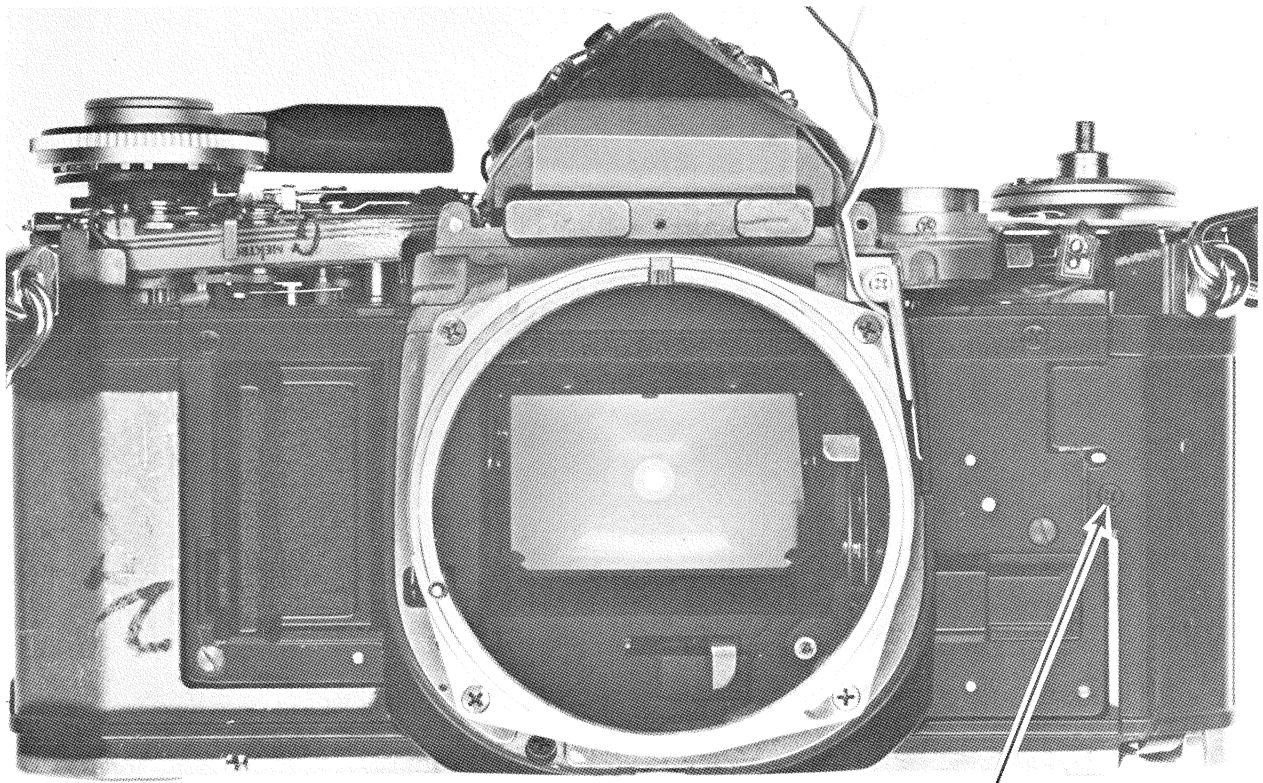
CAUTION: REMOVE BATTERY WHEN
SOLDERING OR UNSOLDERING



50

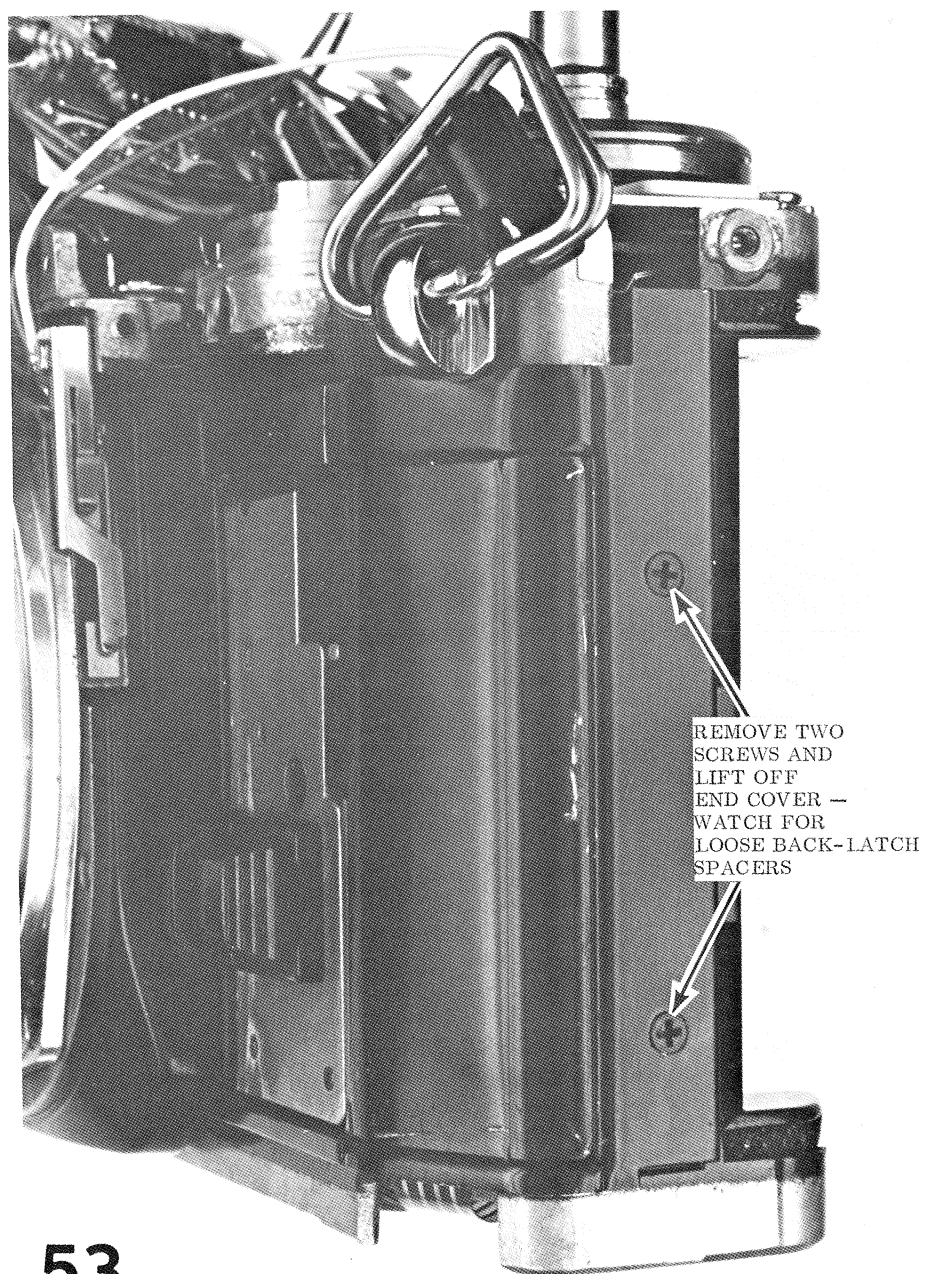


51

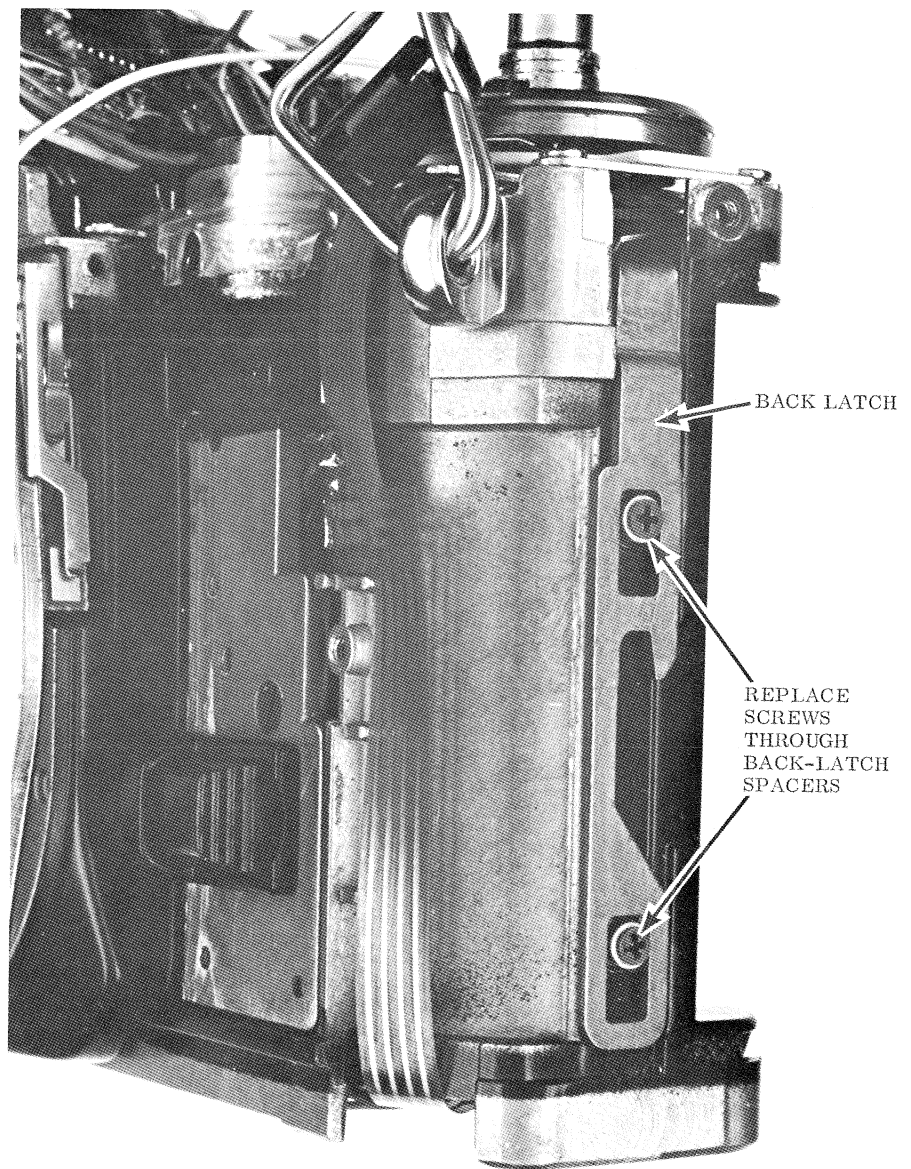


1. REMOVE FRONT-PLATE LEATHERETTE

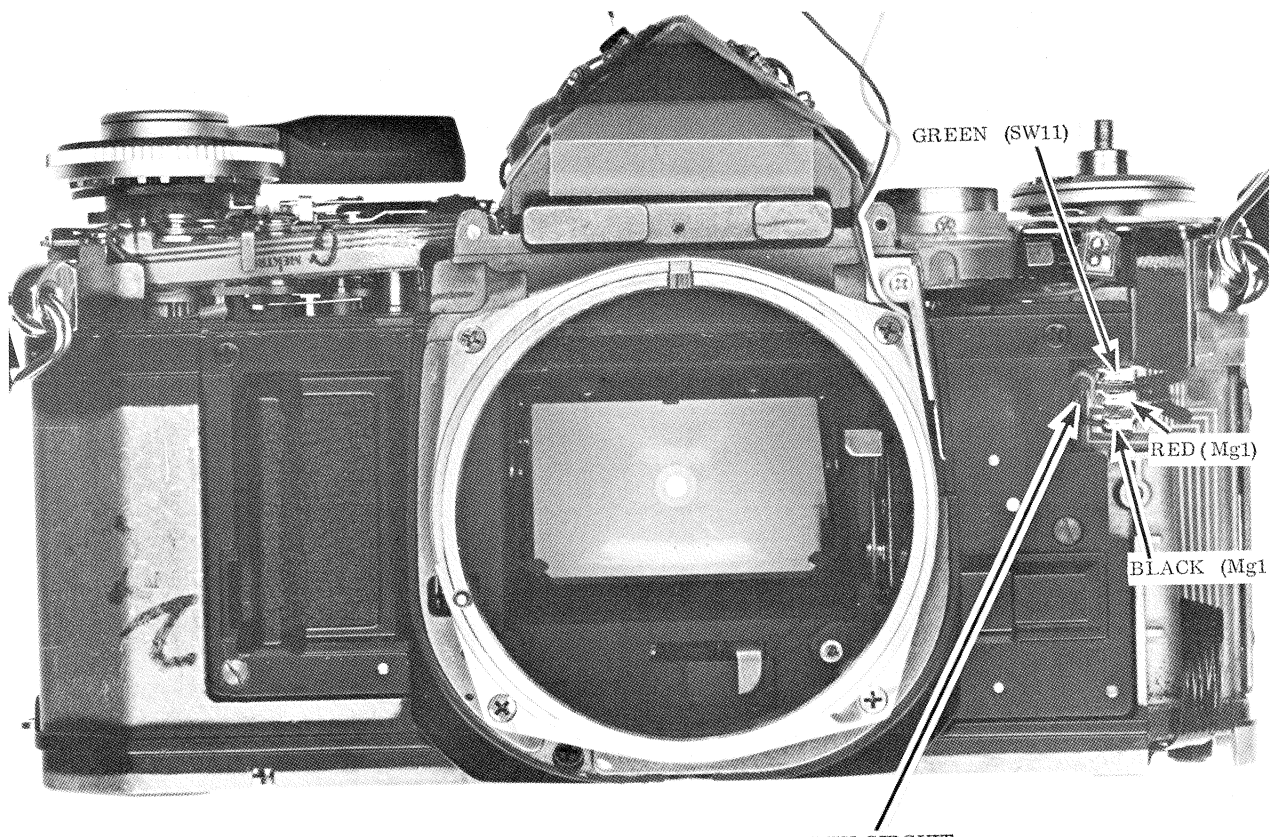
2. REMOVE END-COVER SCREW



53



54



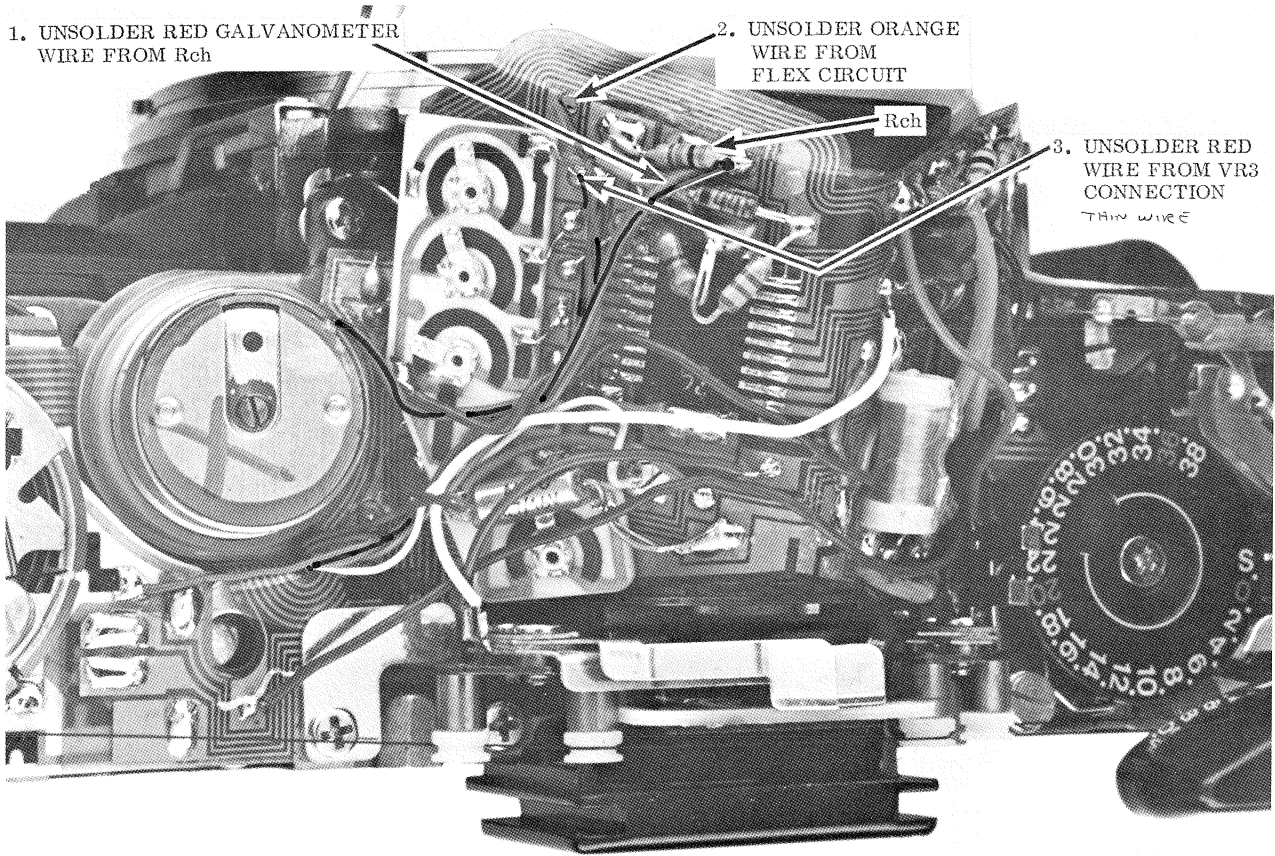
UNSOLDER WIRES FROM FRONT OF FLEX CIRCUIT

1. UNSOLDER RED GALVANOMETER
WIRE FROM Rch

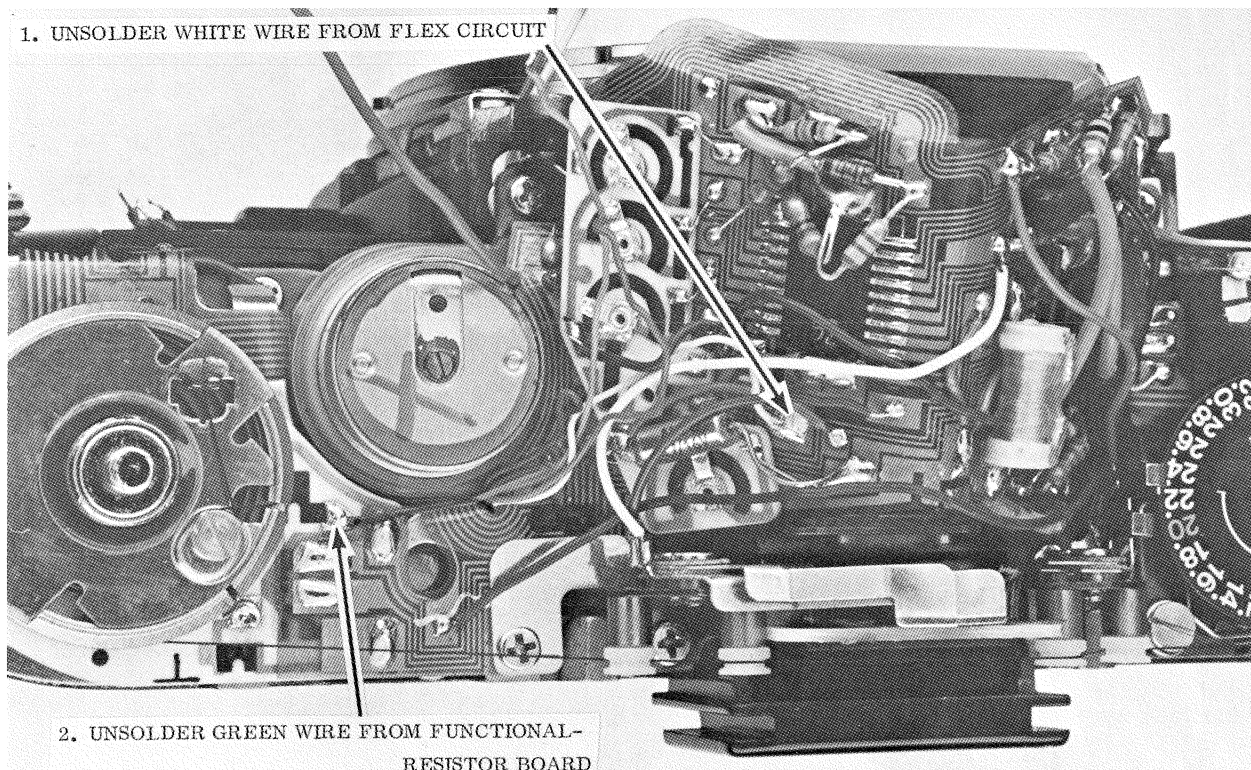
2. UNSOLDER ORANGE
WIRE FROM
FLEX CIRCUIT

Rch

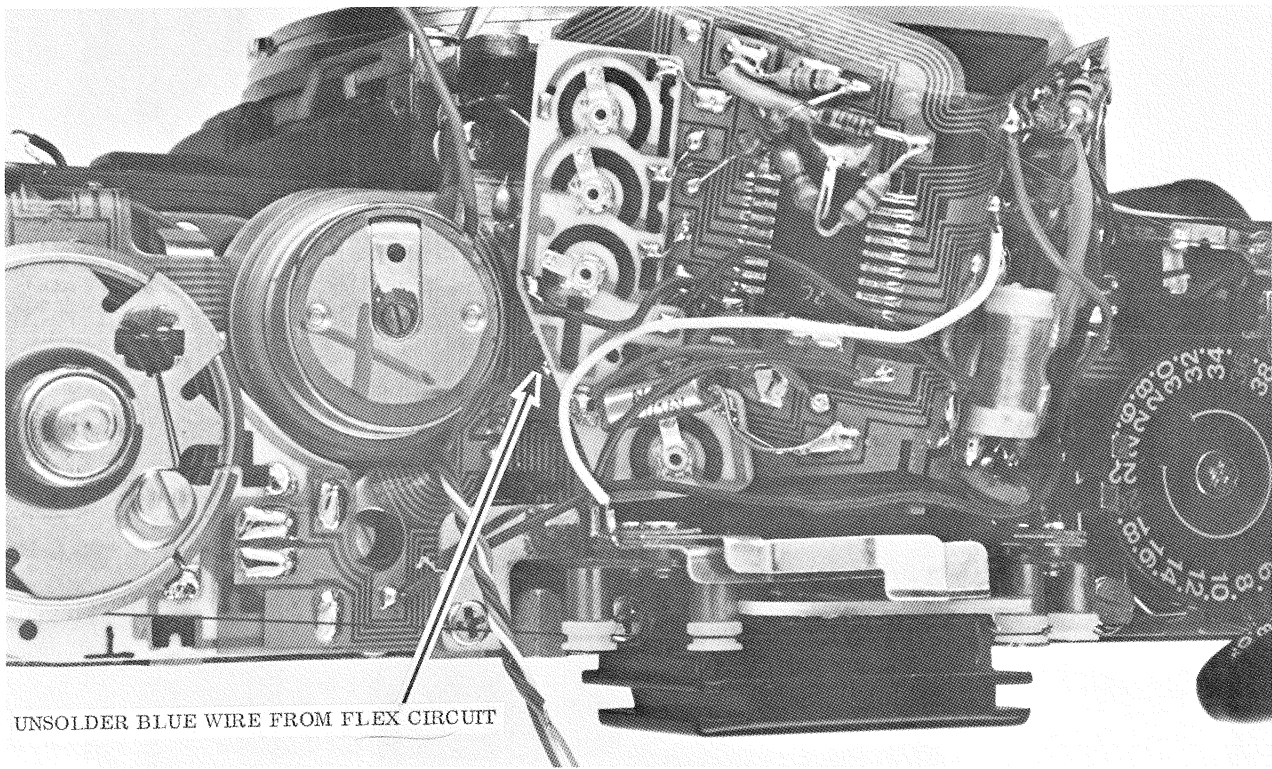
3. UNSOLDER RED
WIRE FROM VR3
CONNECTION
THIN WIRE



1. UNSOLDER WHITE WIRE FROM FLEX CIRCUIT

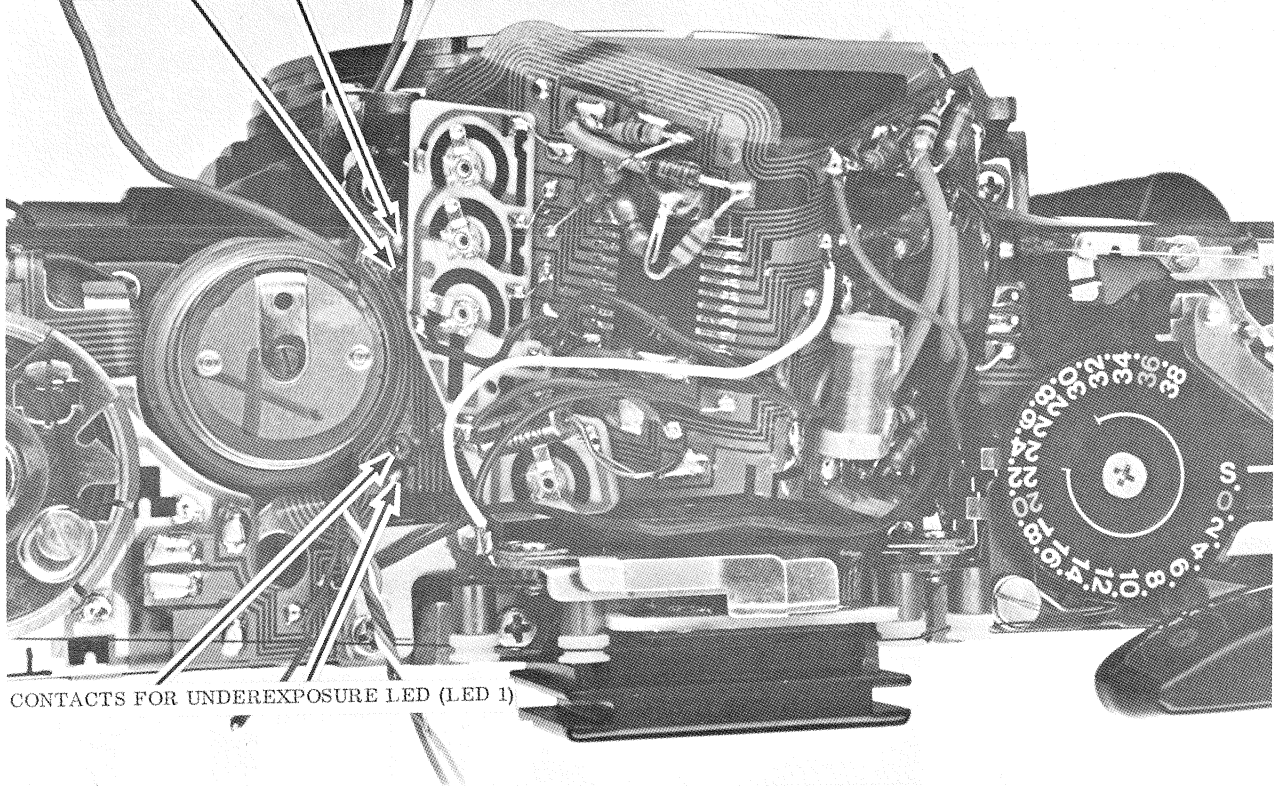


2. UNSOLDER GREEN WIRE FROM FUNCTIONAL-
RESISTOR BOARD



58

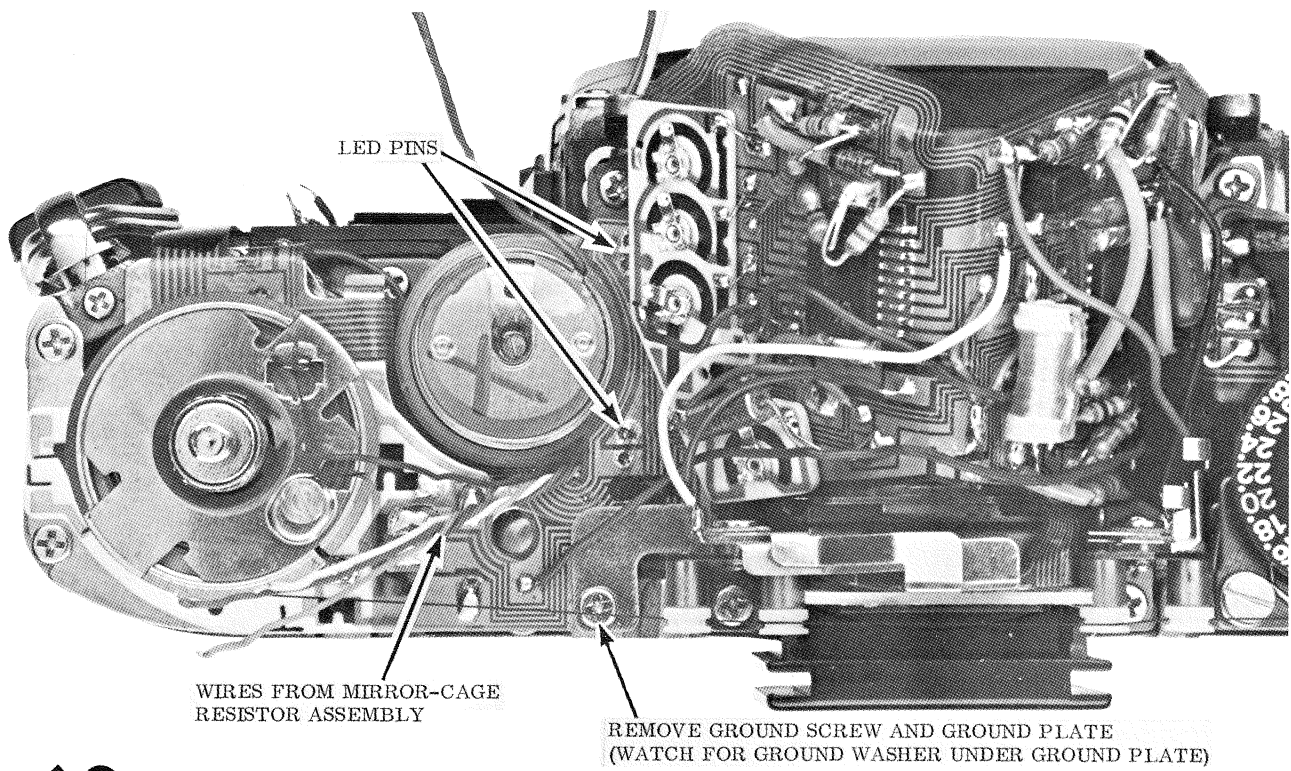
CONTACTS FOR MANUAL LED (LED4)



CONTACTS FOR UNDEREXPOSURE LED (LED 1)

59

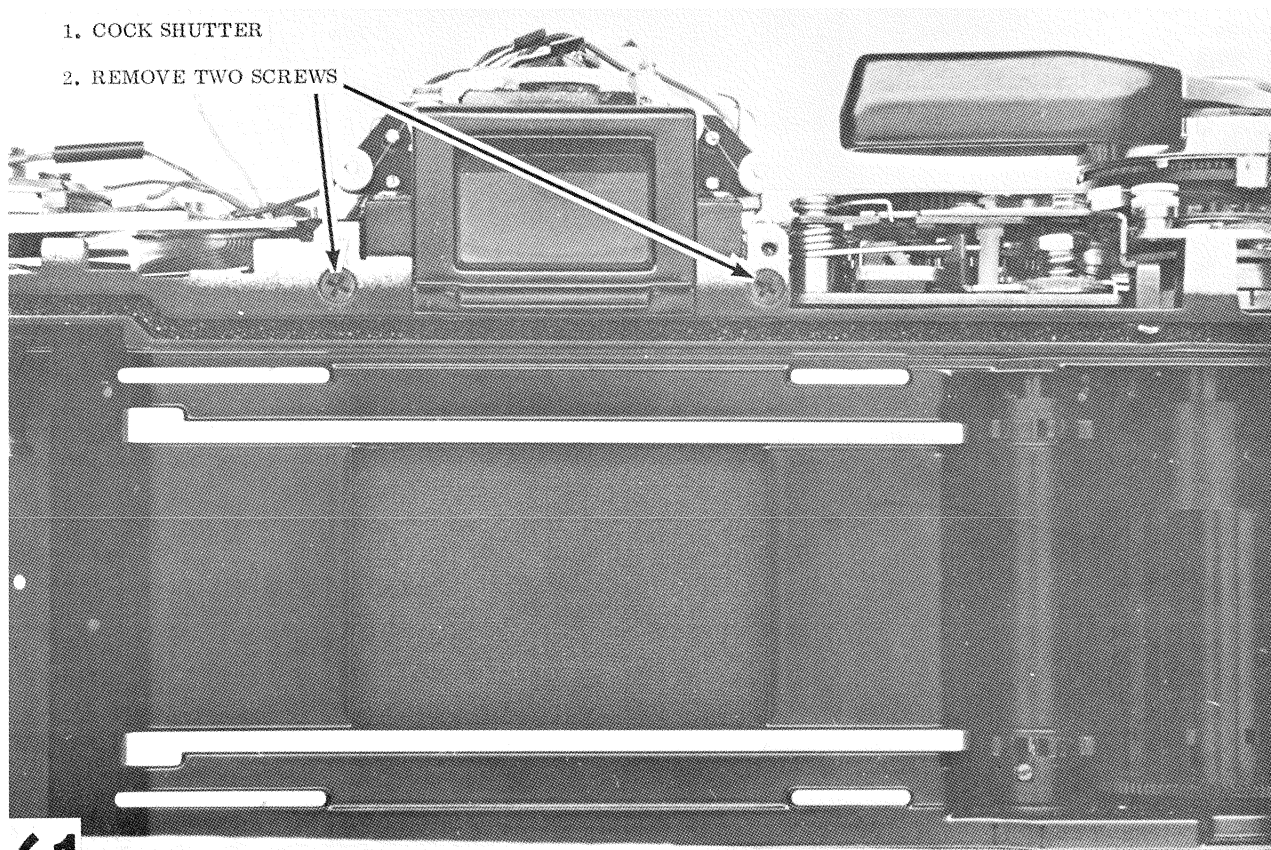
USE SOLDER WICK TO REMOVE SOLDER FROM LED CONTACTS



60

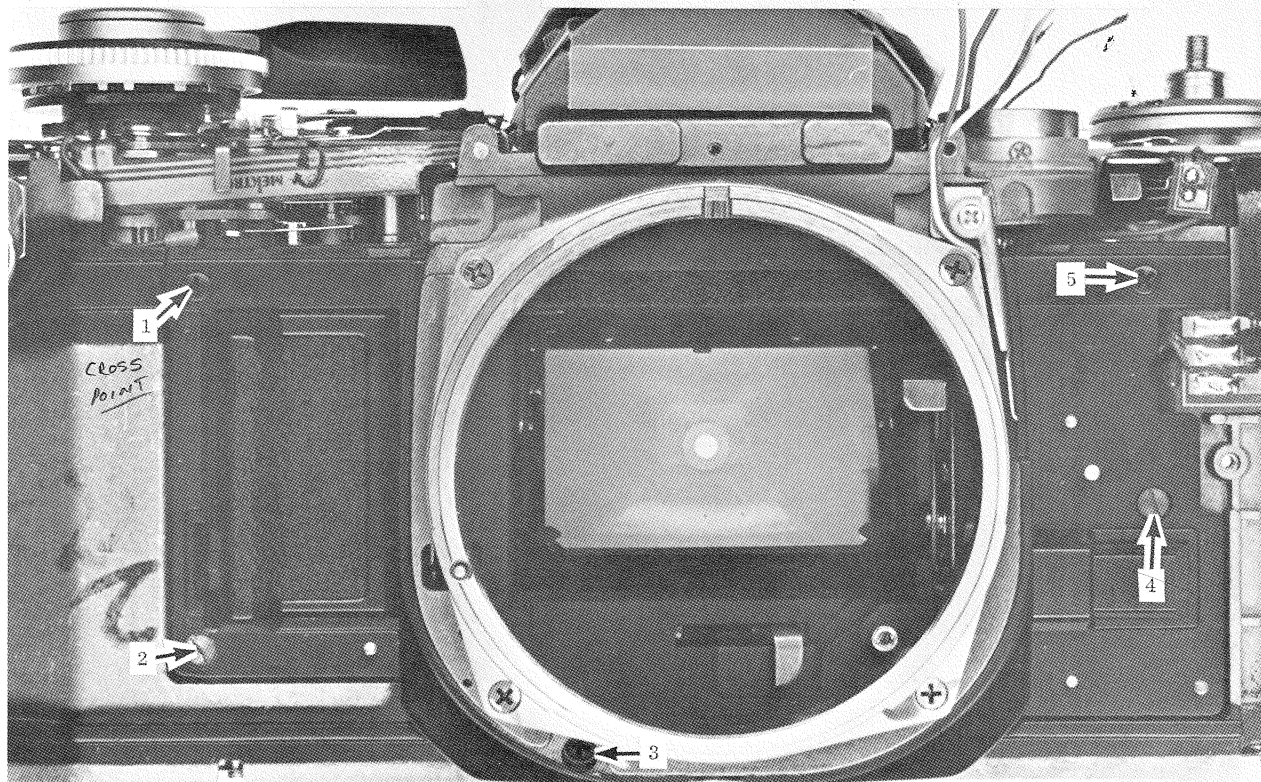
1. COCK SHUTTER

2. REMOVE TWO SCREWS



1. REMOVE FIVE FRONT-PLATE SCREWS

2. LIFT OUT FRONT-PLATE/MIRROR-CAGE ASSEMBLY

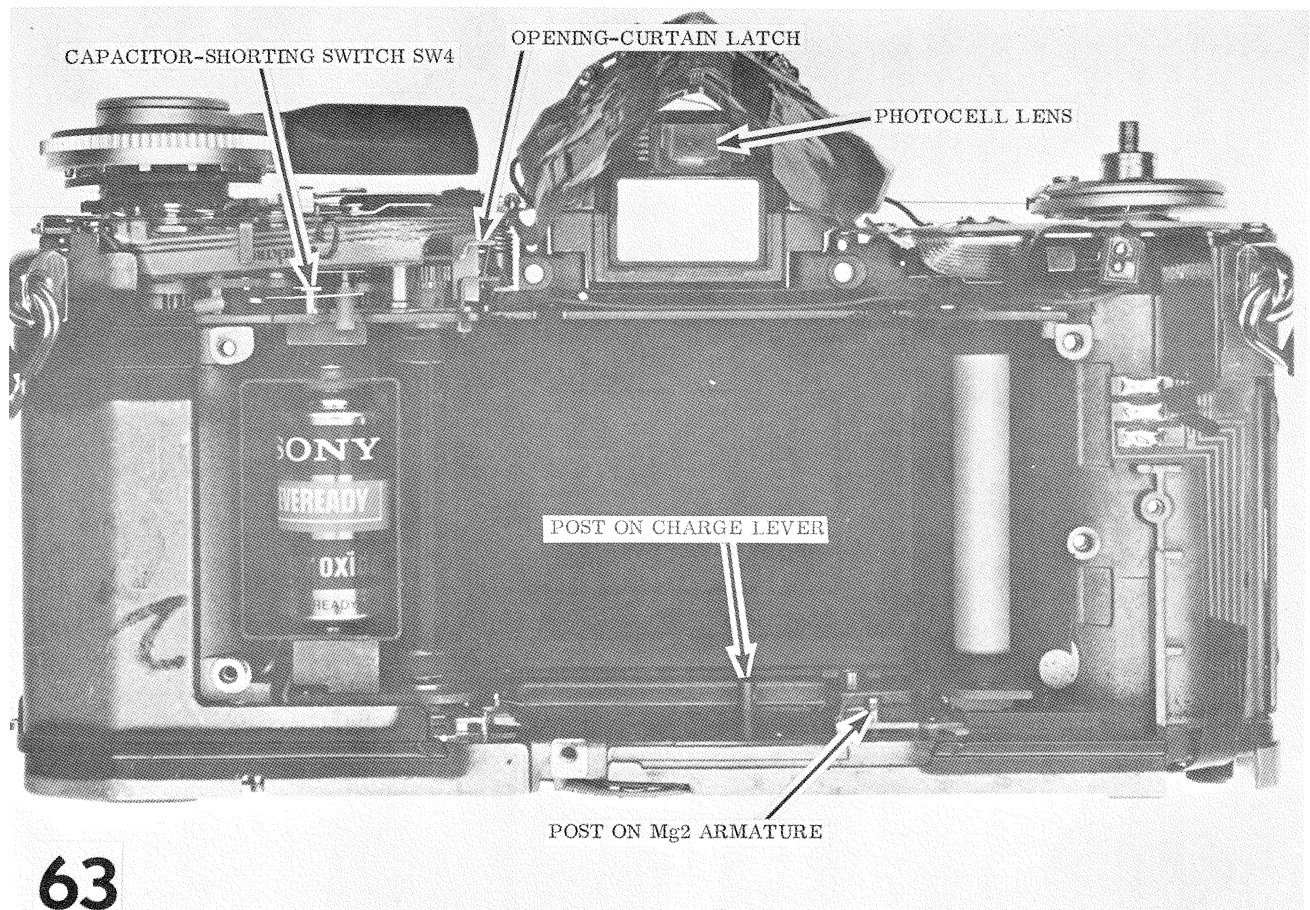


NOTE DIFFERENT SHAPES OF SCREWS --

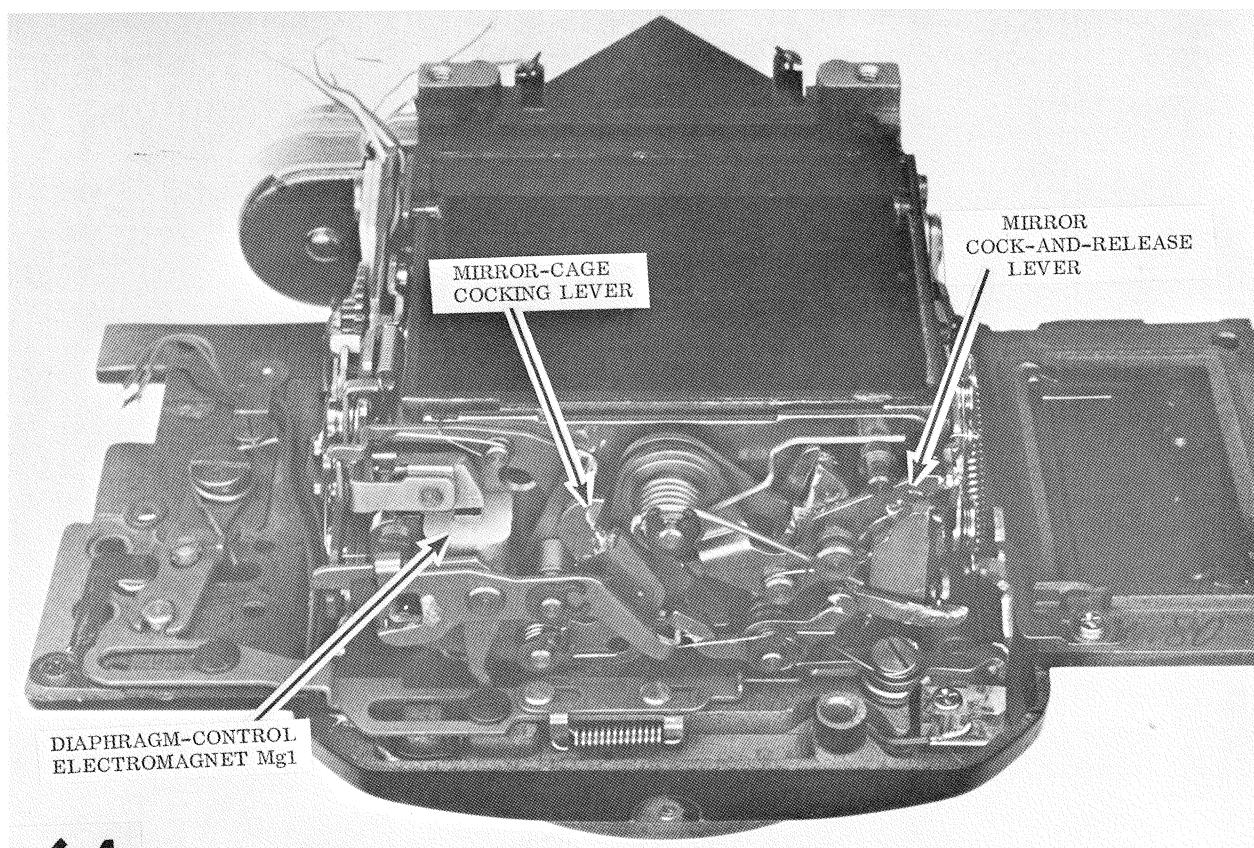
62

2 AND 4 ARE SHOULDERED POSITIONING SCREWS, 3 IS THE SAME AS THE TWO AT THE BACK OF THE MIRROR CAGE

3 FLAT HEAD

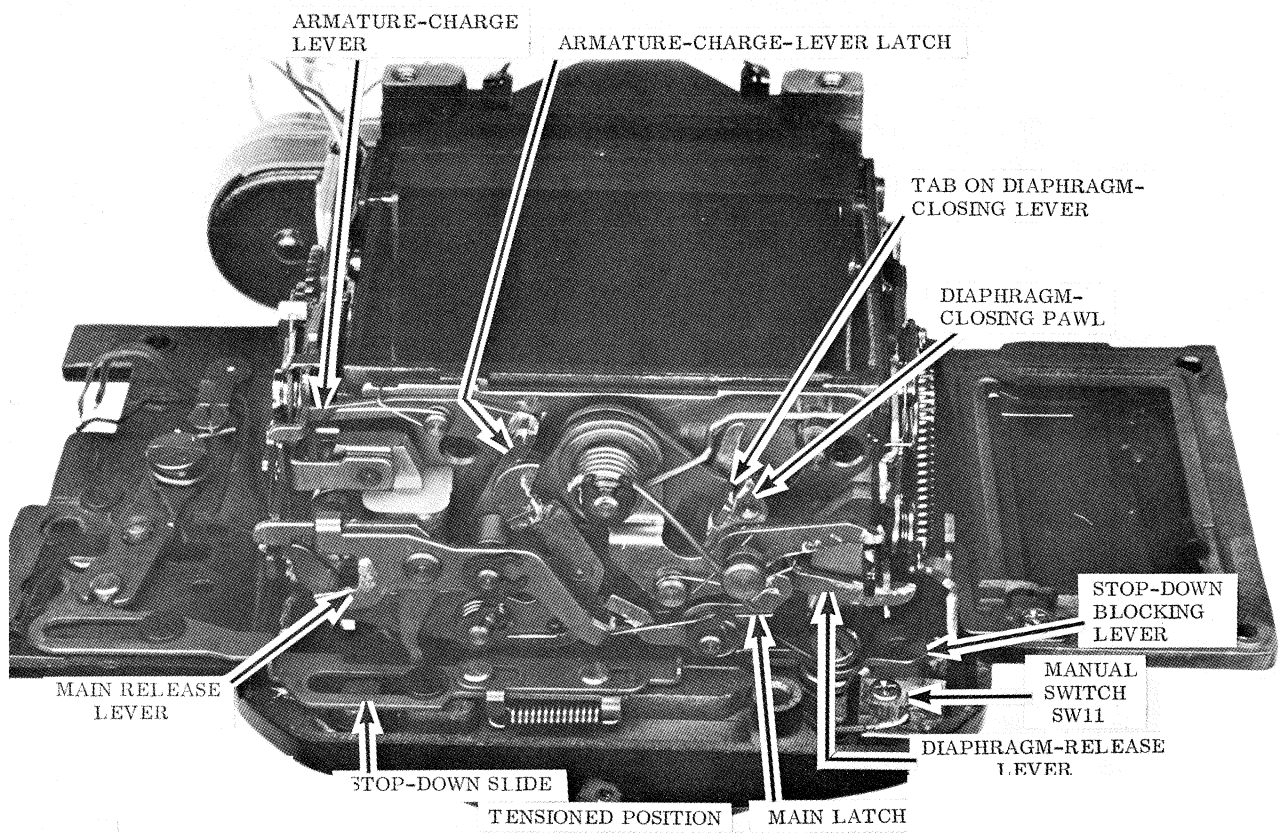


To operate the shutter, first replace the ground plate and the battery. Then, cock the shutter and depress the release switch -- the armature of Mg2 should jump away from the combination magnet. Next, push the Mg3 armature against the closing-curtain electromagnet -- the electromagnet should hold the armature. Push in the opening-curtain latch to release the shutter. If you hold the opening-curtain latch, the shutter should deliver whatever shutter speed you've selected.

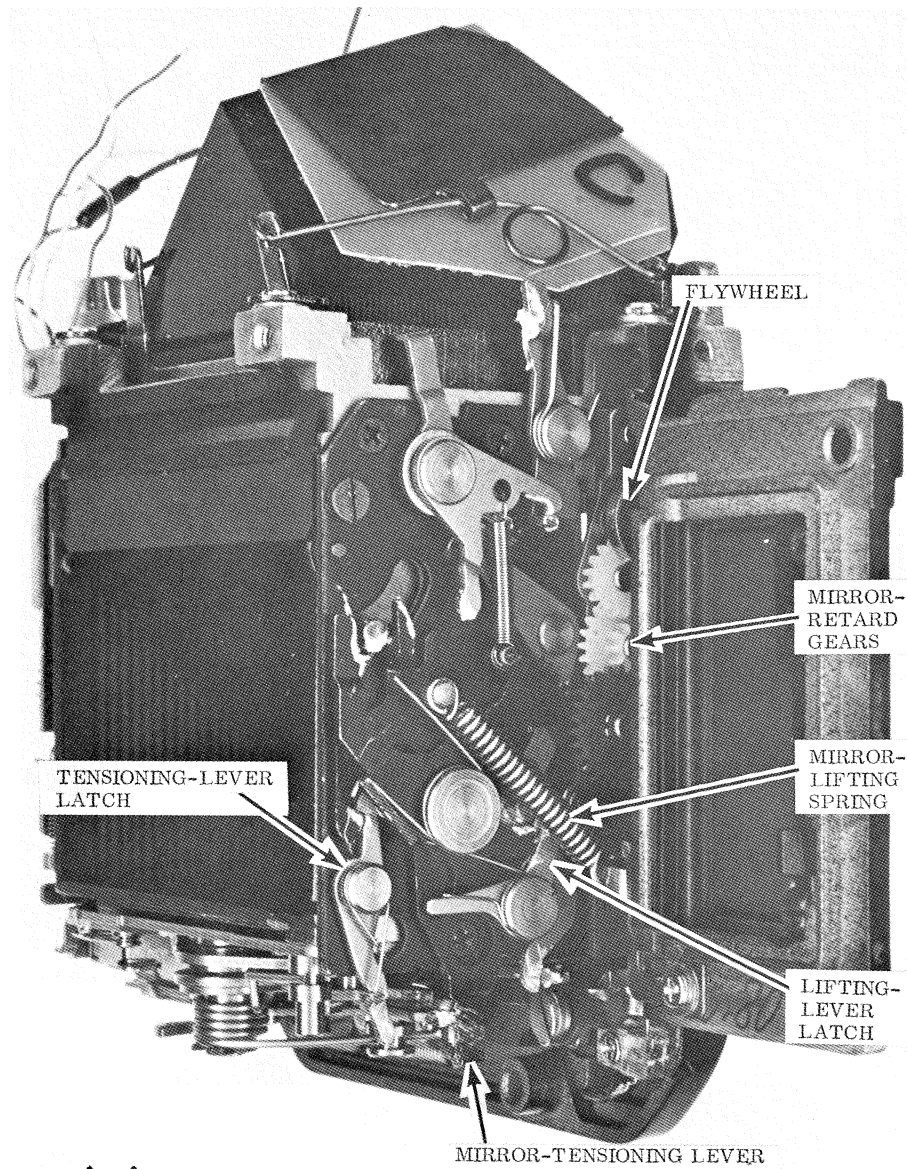


64

RELEASED POSITION

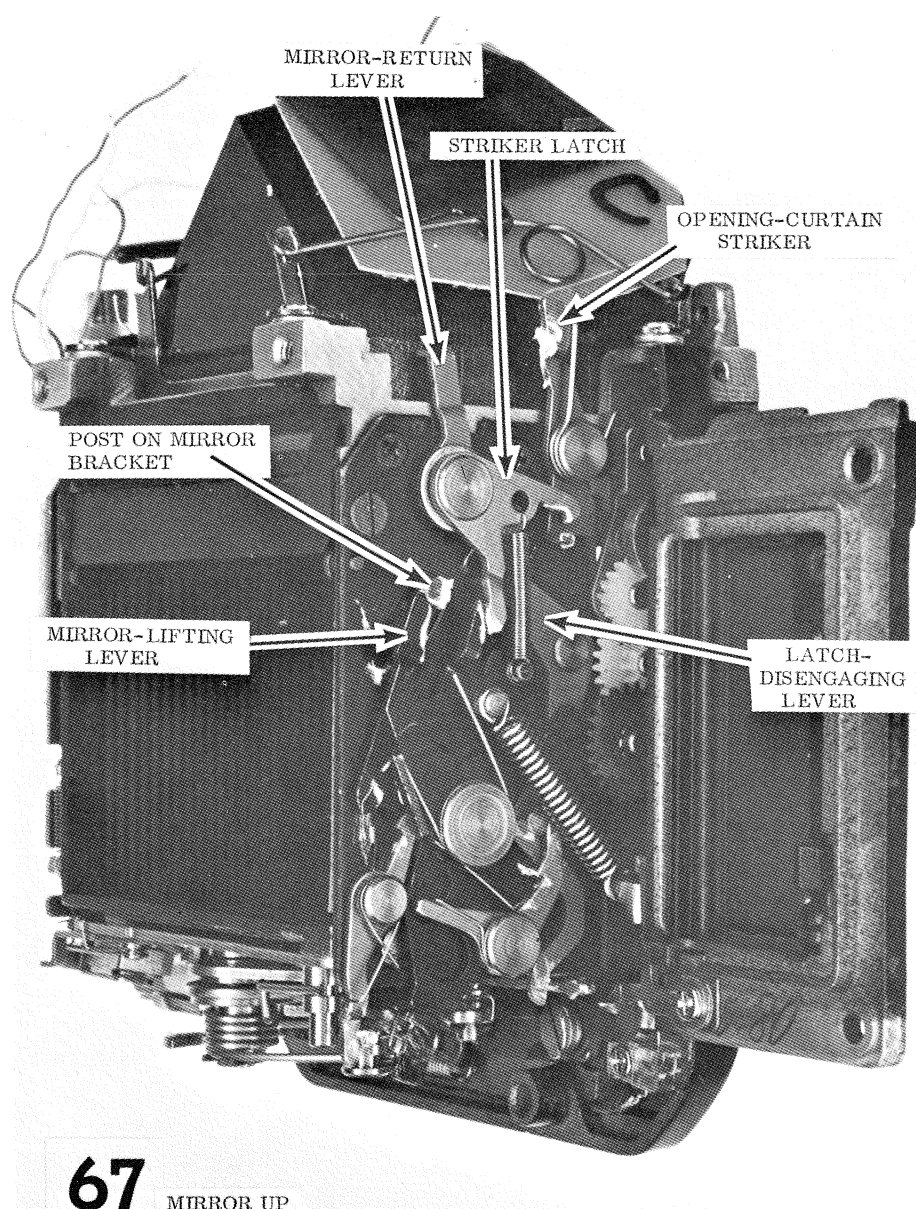


65

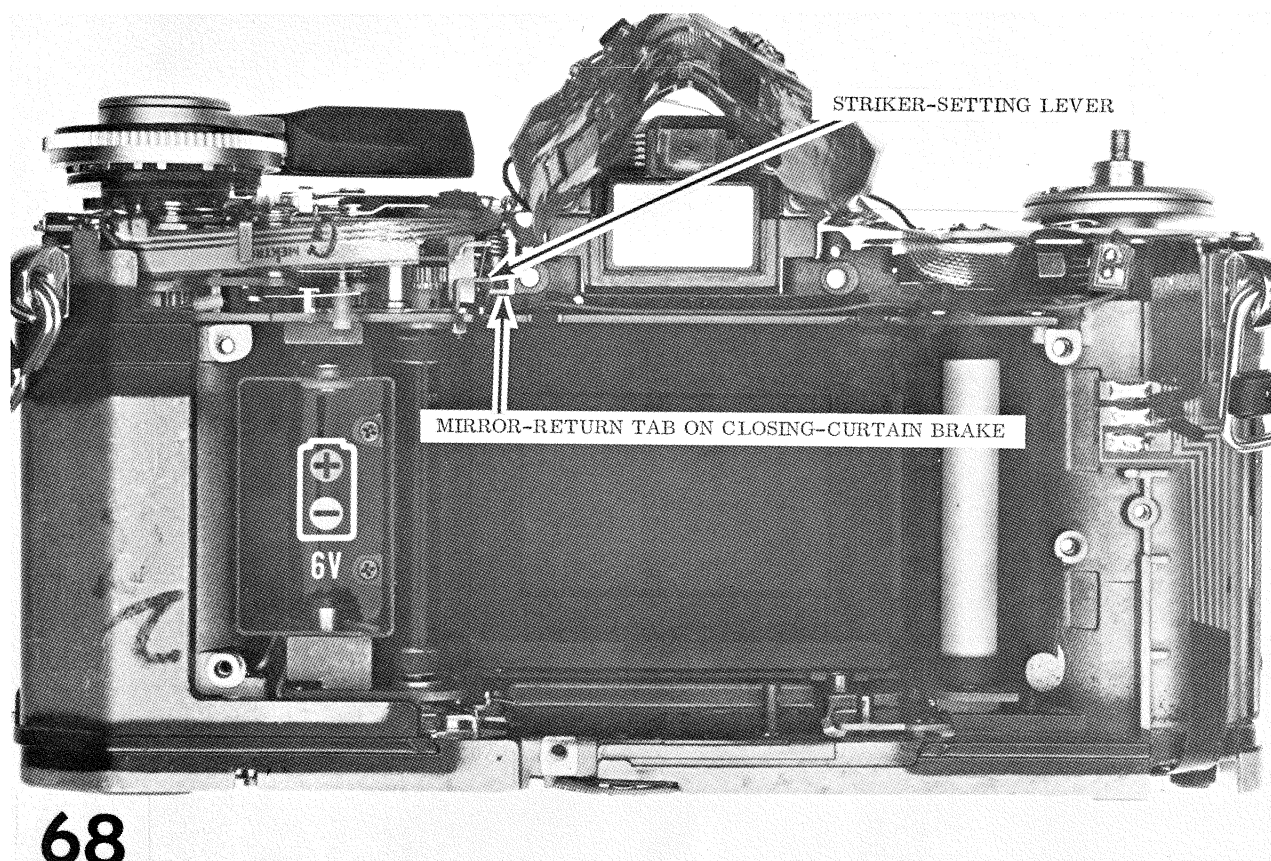


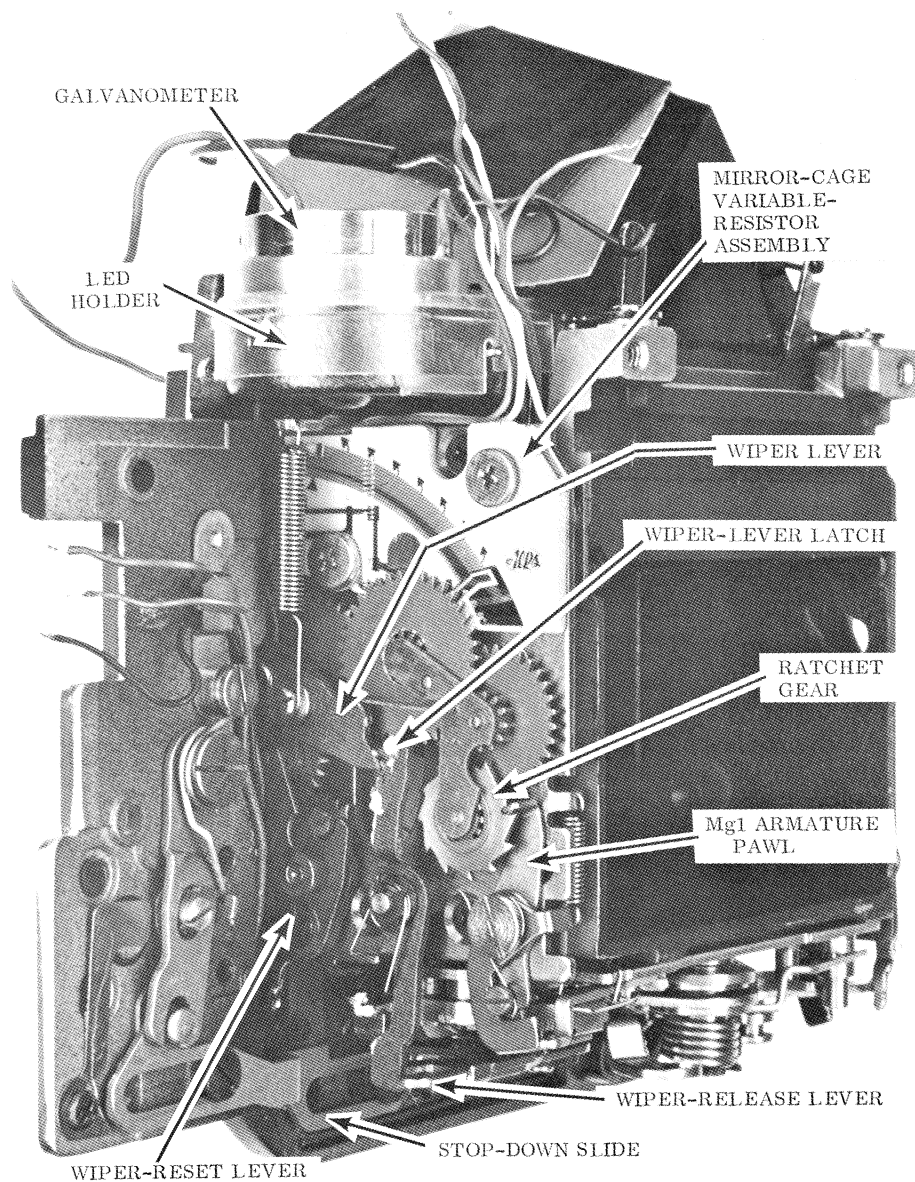
66

MIRROR TENSIONED



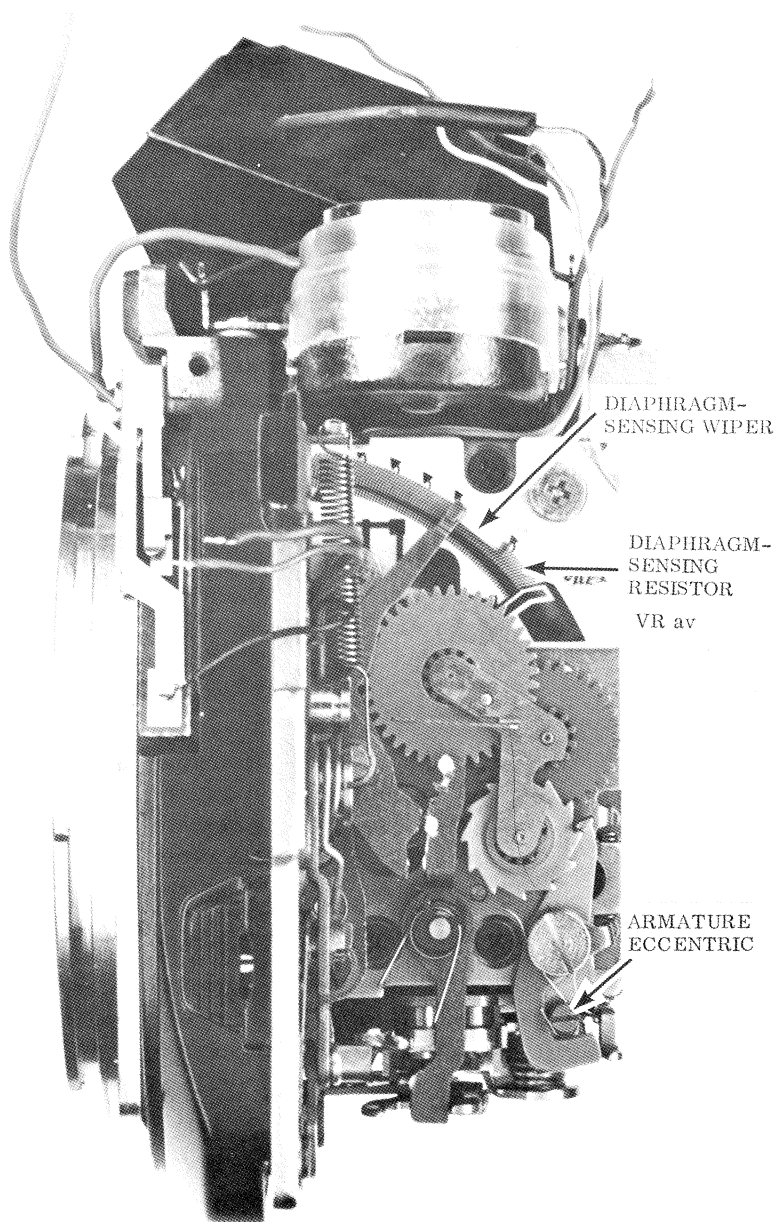
The shutter should release when the mirror is 2 ± 1 mm from the edge of the porous-plastic pad at the front of the mirror cage. Make the adjustment by bending the end of the mirror-lifting lever that contacts the mirror-bracket post.





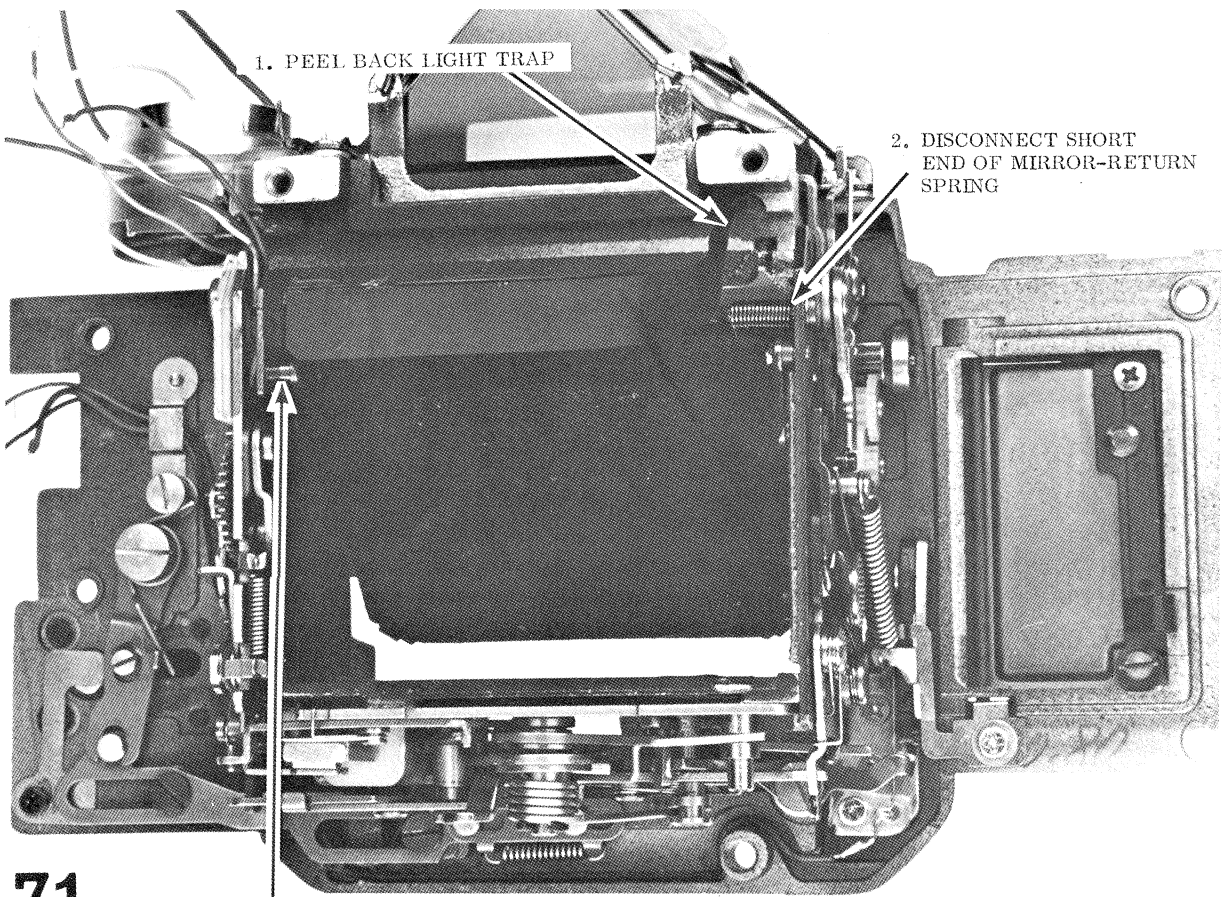
69

When you cock the shutter, the wiper lever latches on the top of the wiper-lever latch. Notice that the wiper-lever latch also has a second step. The second step allows you to go from "A" to a manual f/stop setting and use the depth-of-field preview. When you push in the stop-down lever, the wiper-lever latch frees the wiper lever. So, if you then go back to "A," the camera won't program the f/stop automatically. You must first set the largest lens aperture -- that allows the wiper-lever latch to engage the wiper lever when you disengage the stop-down lever. The wiper lever now latches on the second step of the wiper-lever latch.

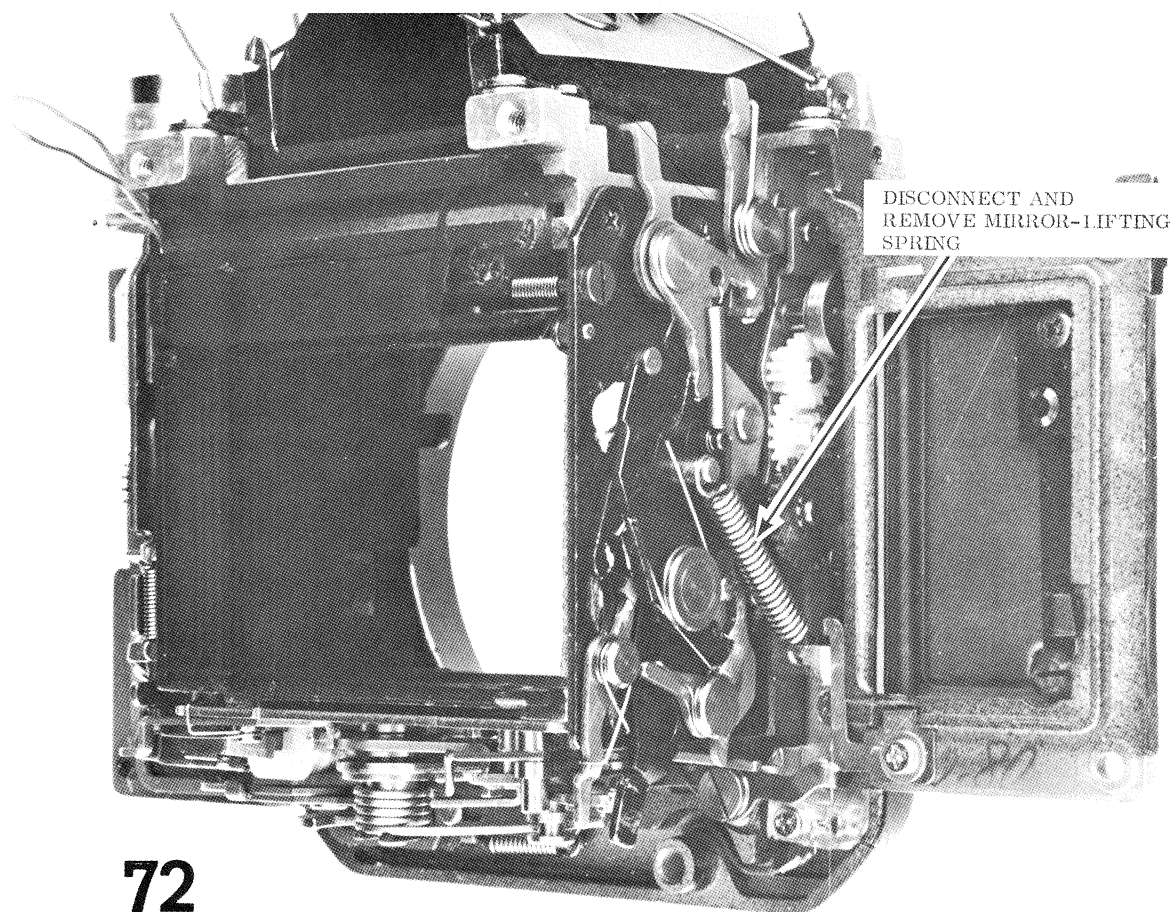


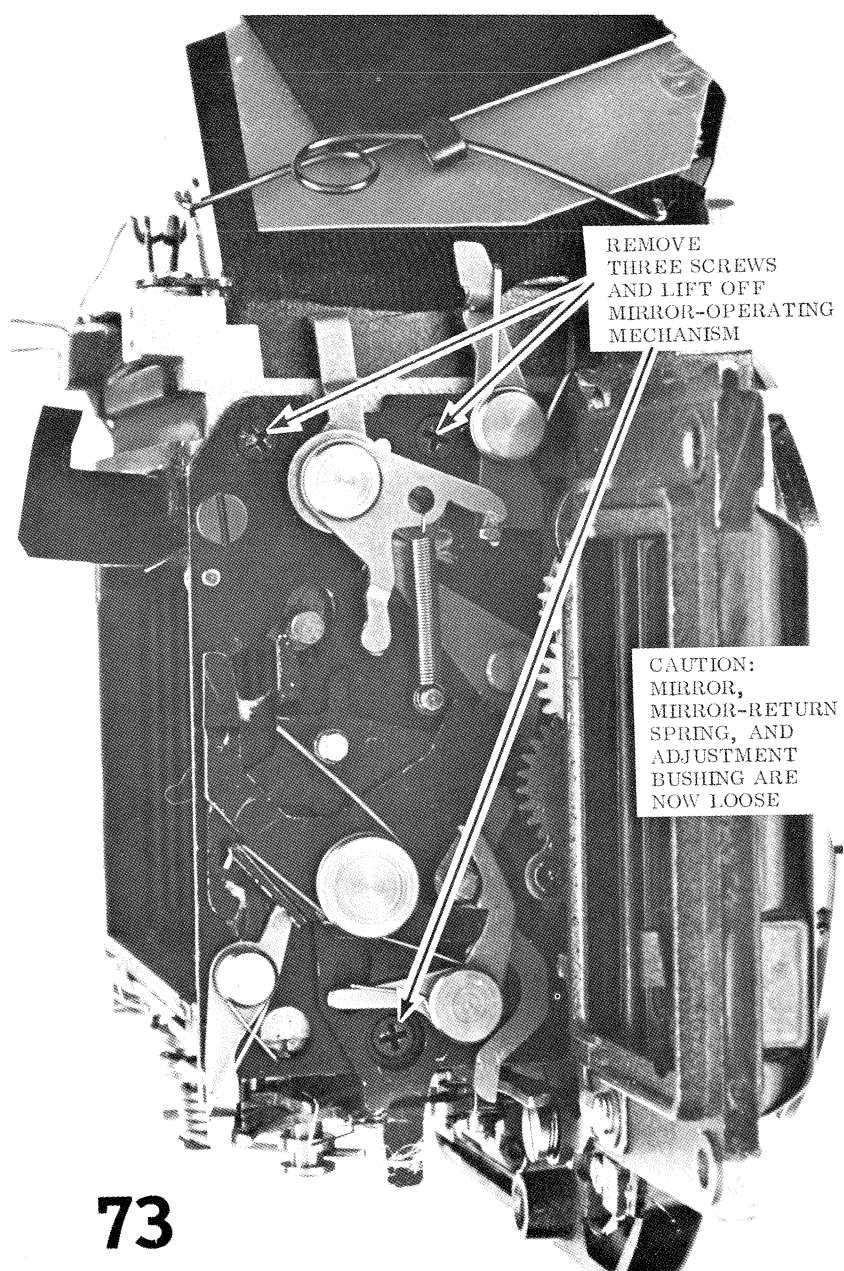
70

To check the overtravel of the auto-control mechanism, install the lens. Cock and release the mirror cage -- but hold the Mg1 armature pawl and the wiper-lever latch disengaged. The diaphragm should stop down to the smallest f/stop. Then, slowly cock the mirror cage while counting the turns of the ratchet gear. If you're using the f/1.4 lens, the ratchet gear should make 6 complete turns plus an additional 8 teeth when the wiper lever latches on the top step of the wiper-lever latch. If you have the f/1.8 lens, the ratchet gear should make 6 complete turns plus an additional 4 teeth. The adjustment point is the eccentric under the wiper-lever latch.



The adjustment bushing on the mirror pivot controls the lateral movement of the mirror. The sideplay should be 0.05 - 0.15mm.

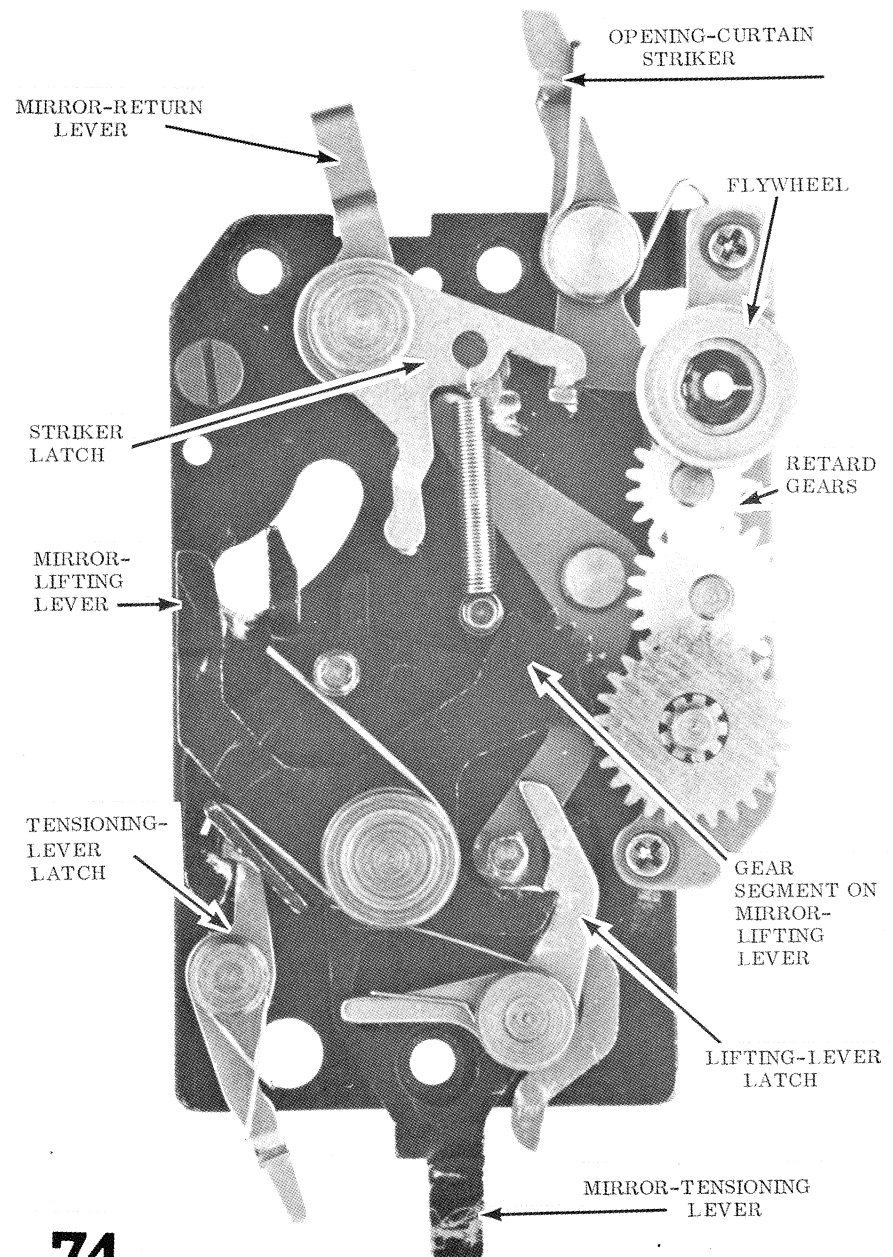




REMOVE
THREE SCREWS
AND LIFT OFF
MIRROR-OPERATING
MECHANISM

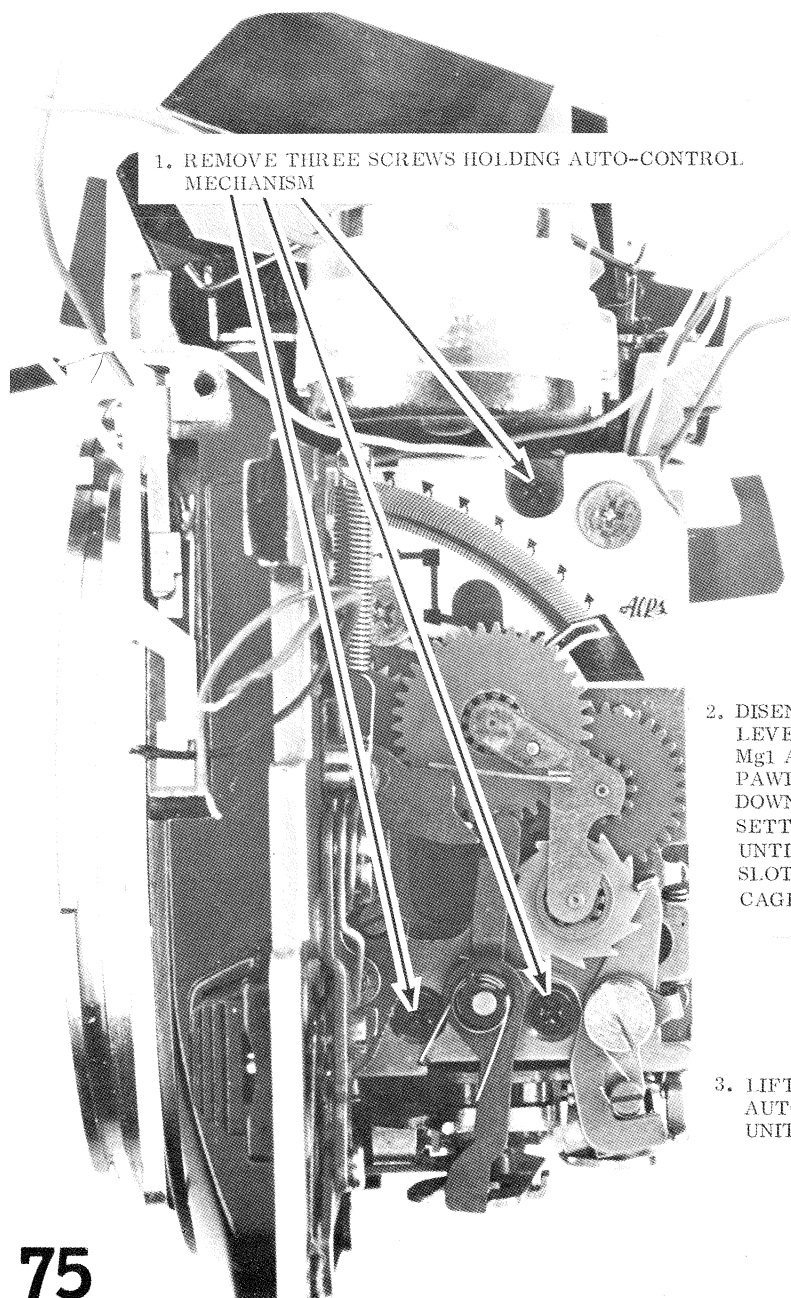
CAUTION:
MIRROR,
MIRROR-RETURN
SPRING, AND
ADJUSTMENT
BUSHING ARE
NOW LOOSE

73



74

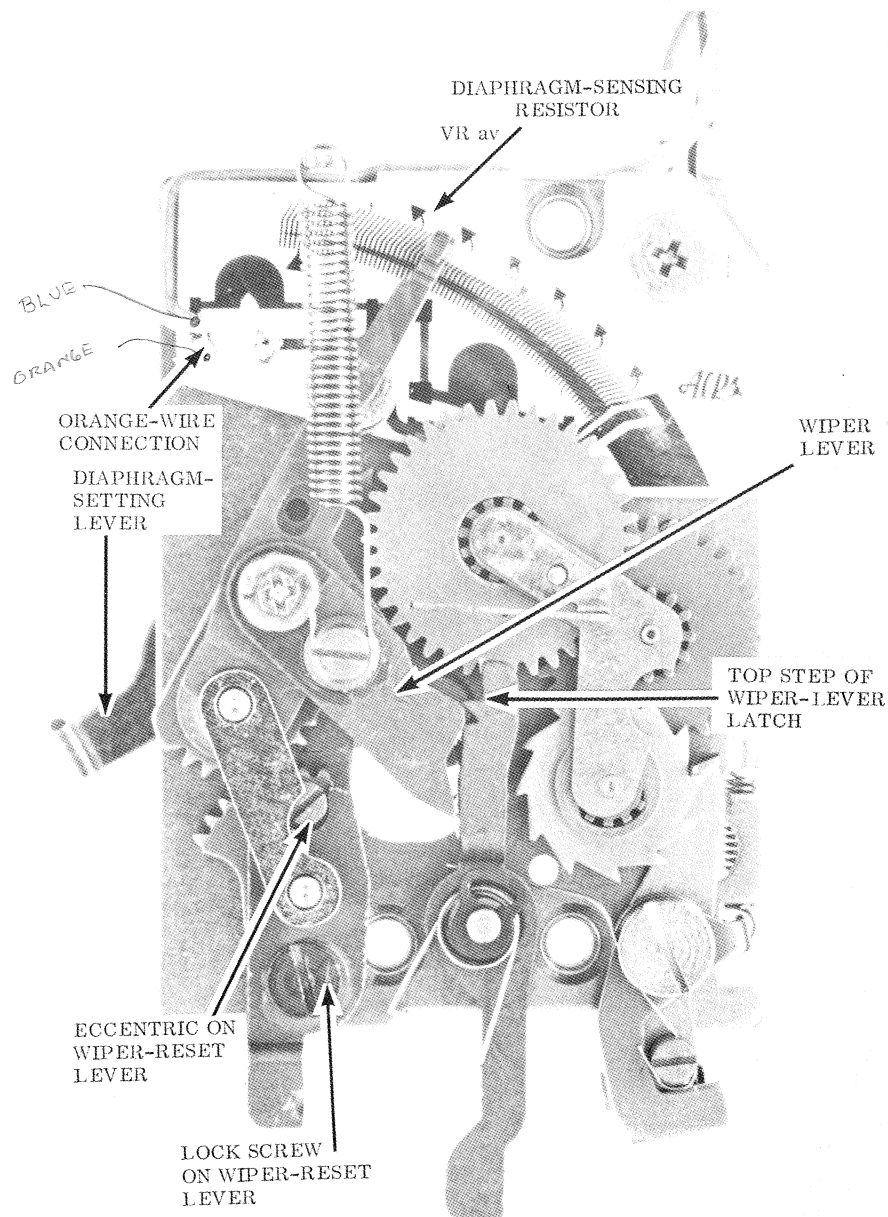
MIRROR-OPERATING MECHANISM



1. REMOVE THREE SCREWS HOLDING AUTO-CONTROL MECHANISM

2. DISENGAGE WIPER-LEVER LATCH AND Mg1 ARMATURE PAWL - MOVE DOWN DIAPHRAGM-SETTING LEVER UNTIL IT CLEARS SLOT IN MIRROR CAGE

3. LIFT OUT AUTO-CONTROL UNIT



76

AUTO-CONTROL MECHANISM

The eccentric on the wiper-reset lever allows you to adjust the overtravel of the wiper lever. With the mirror cage assembled, hold the mirror-cage cocking lever fully advanced. There should then be a 0.5mm clearance between the latching end of the wiper lever and the top step of the wiper-lever latch. To make the overtravel adjustment, first loosen the lock screw on the wiper-reset lever. Then, turn the eccentric.

When the wiper lever is latched on the top step of the wiper-lever latch, the wiper should not touch the resistance band. So you should measure infinite resistance between the orange wire and ground.

VR AVO
(MAXIMUM-APERTURE
CORRECTION)

RED
GREEN
WHITE

VR AVC
(APERTURE
CORRECTION)

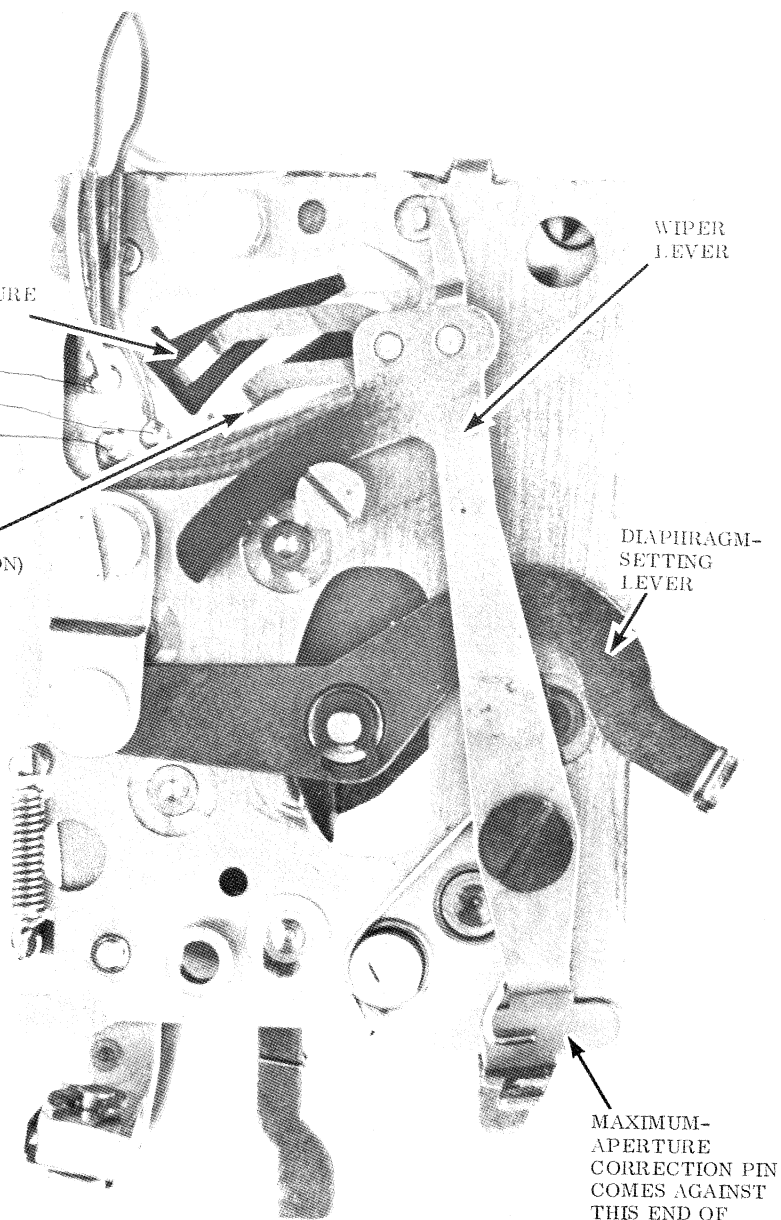
WIPER
LEVER

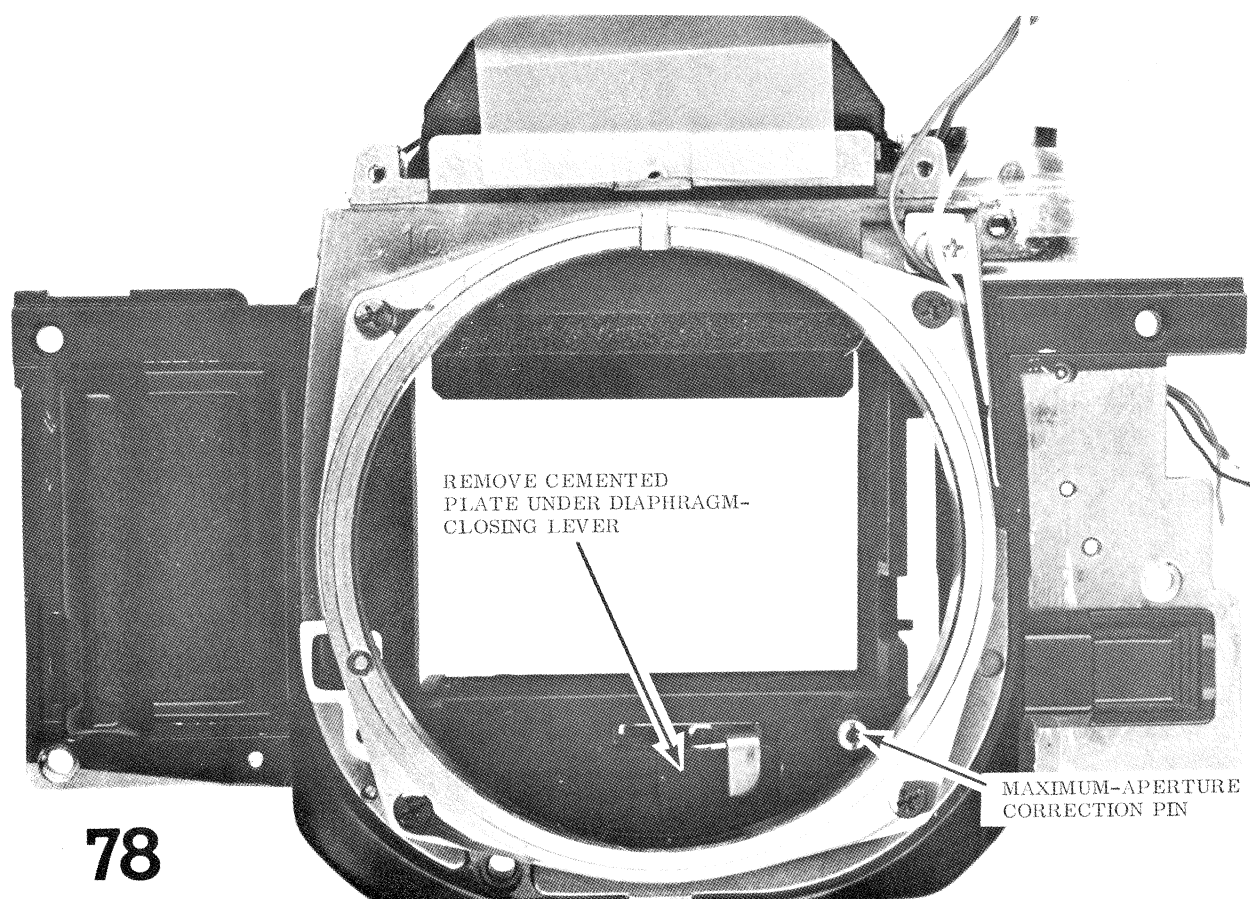
DIAPHRAGM-
SETTING
LEVER

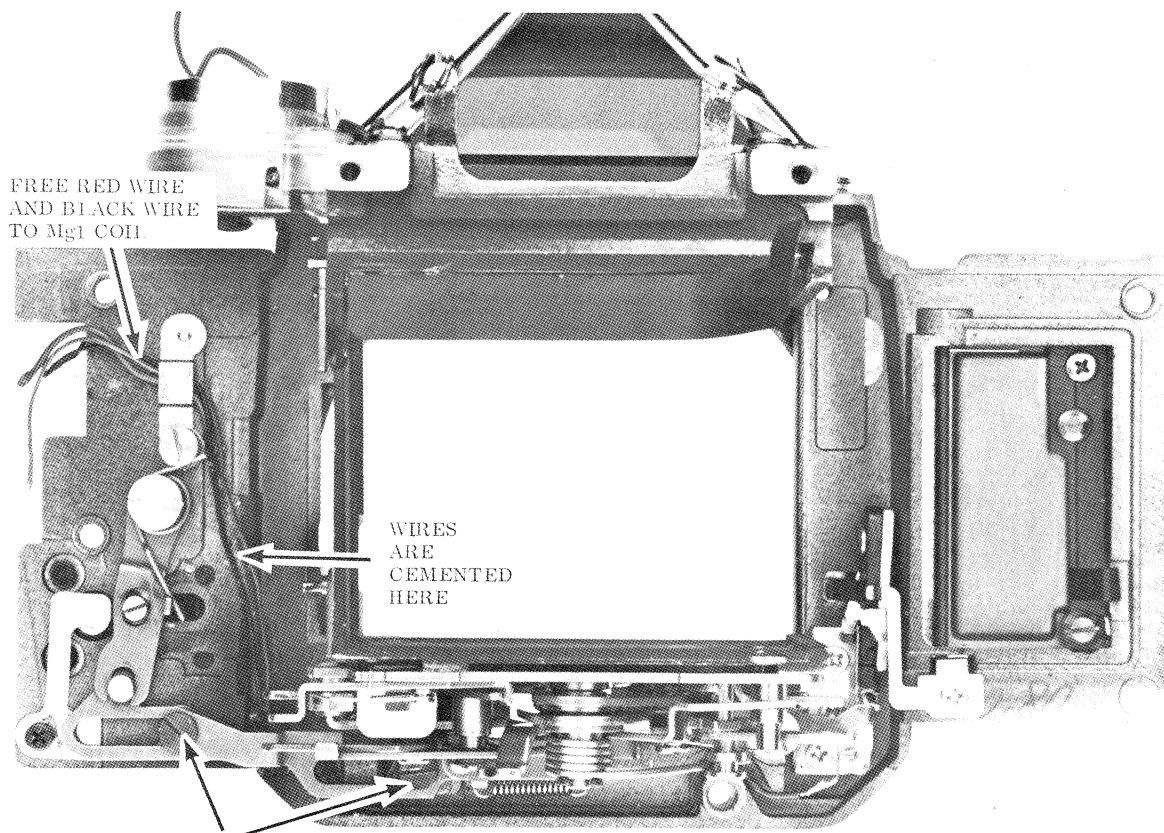
MAXIMUM-
APERTURE
CORRECTION PIN
COMES AGAINST
THIS END OF
WIPER LEVER

77

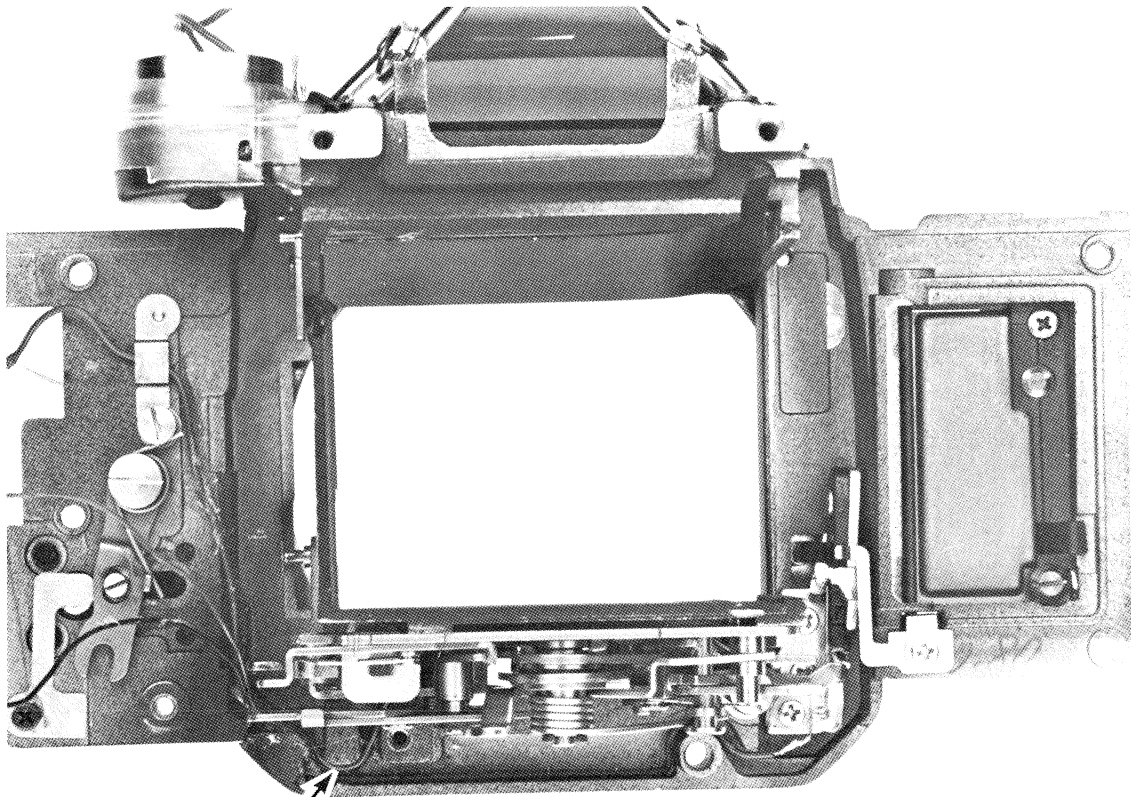
BACK OF AUTO-CONTROL MECHANISM





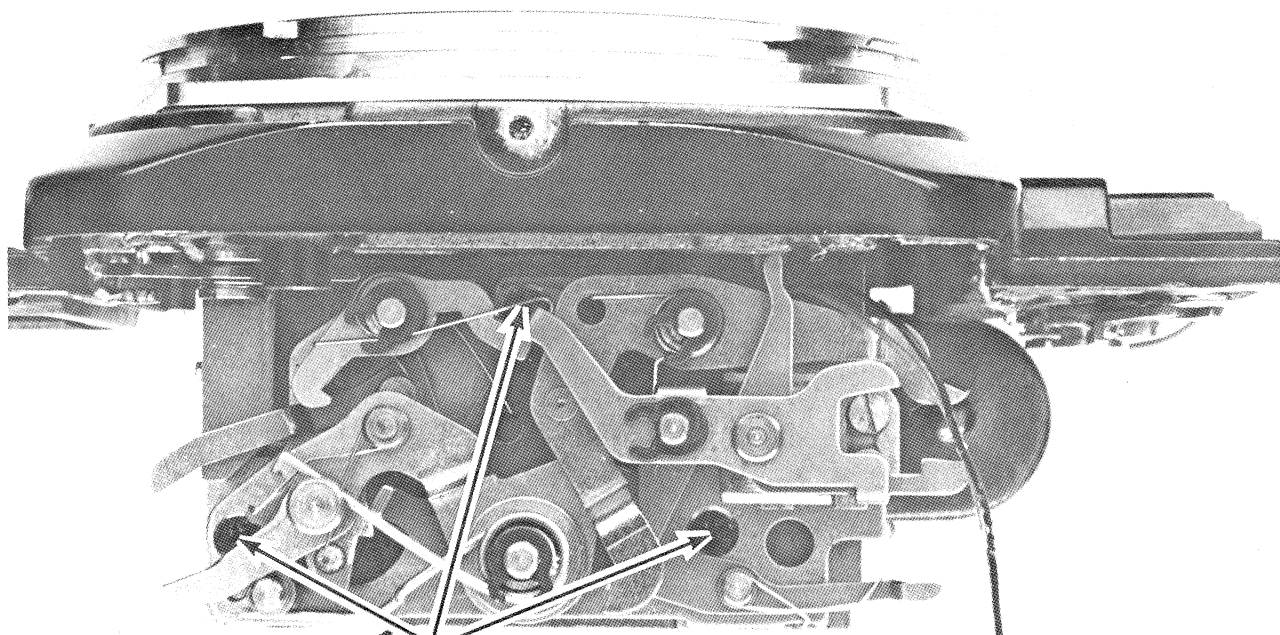


79 NOTE: YOU'LL FIND IT EASIER TO FREE AND REROUTE THE Mg1 WIRES IF YOU FIRST REMOVE THE STOP-DOWN SLIDE BY TAKING OUT THESE TWO SCREWS. HOWEVER, THIS STEP IS NOT NECESSARY.



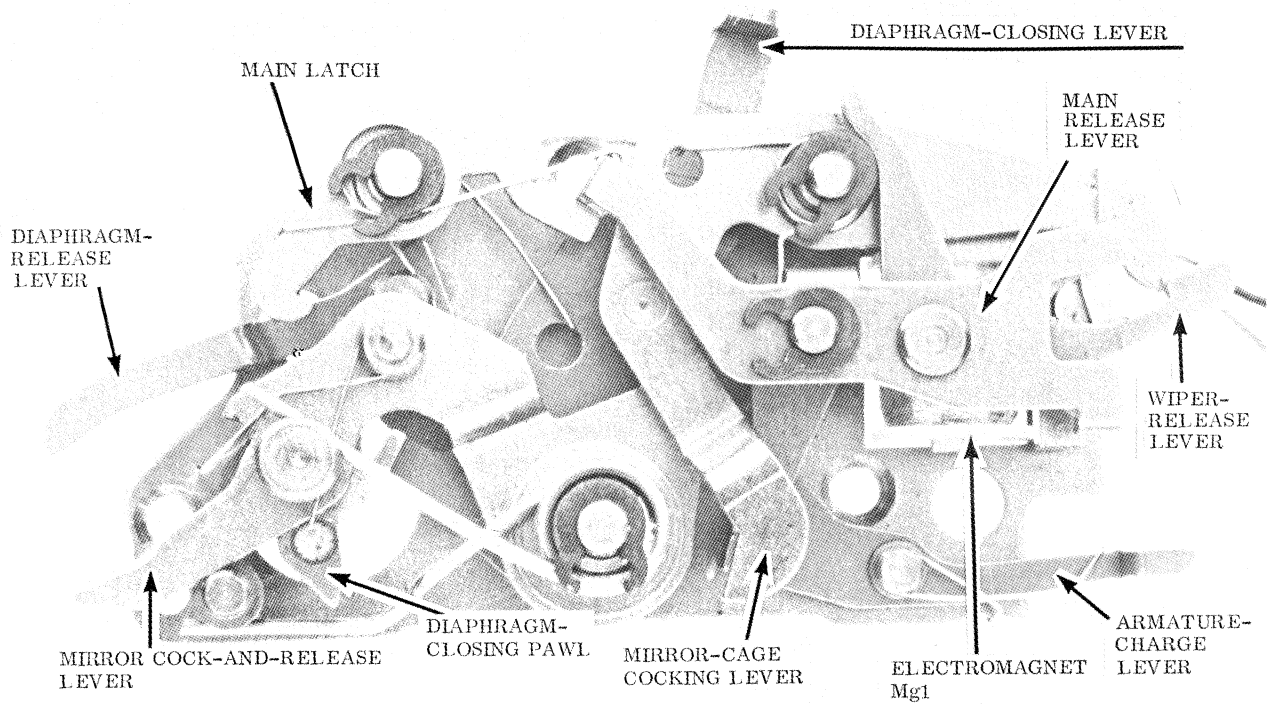
80

NOTE ROUTE OF Mg1 WIRES — WIRES ARE CEMENTED
IN POSITION



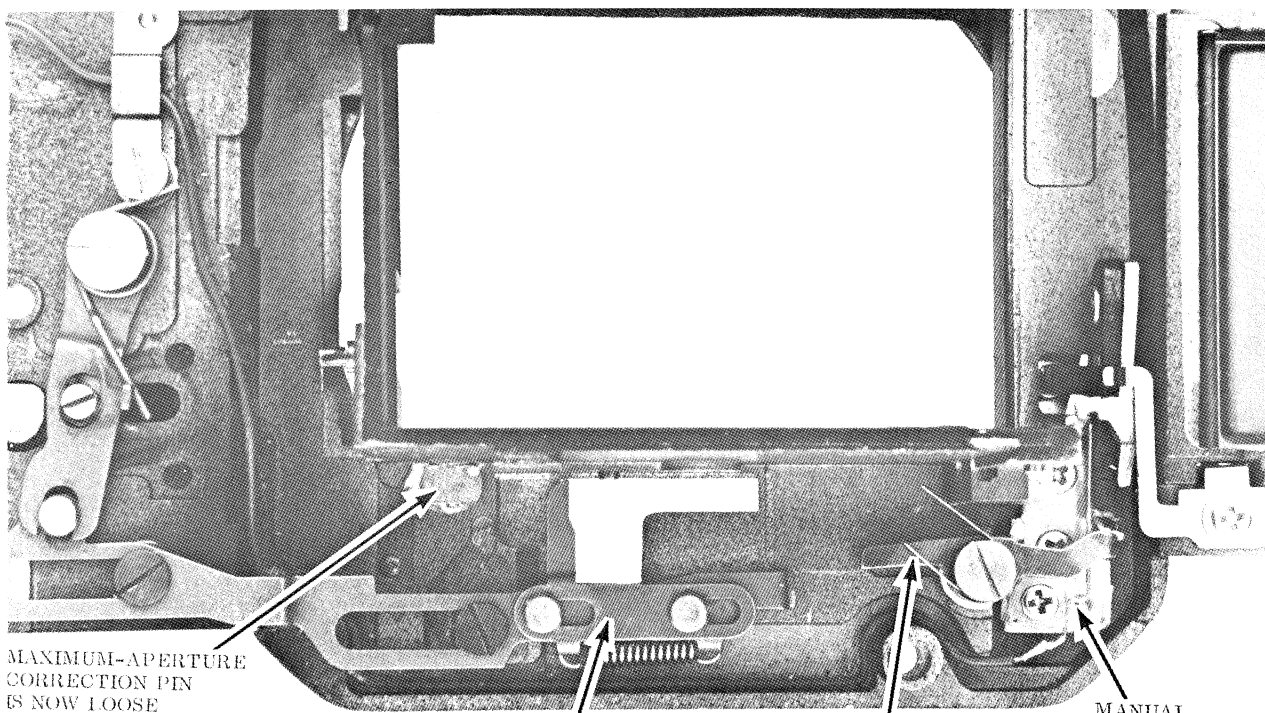
81

REMOVE THREE SCREWS AND LIFT OUT
DIAPHRAGM-CONTROL MECHANISM



82

DIAPHRAGM-CONTROL MECHANISM



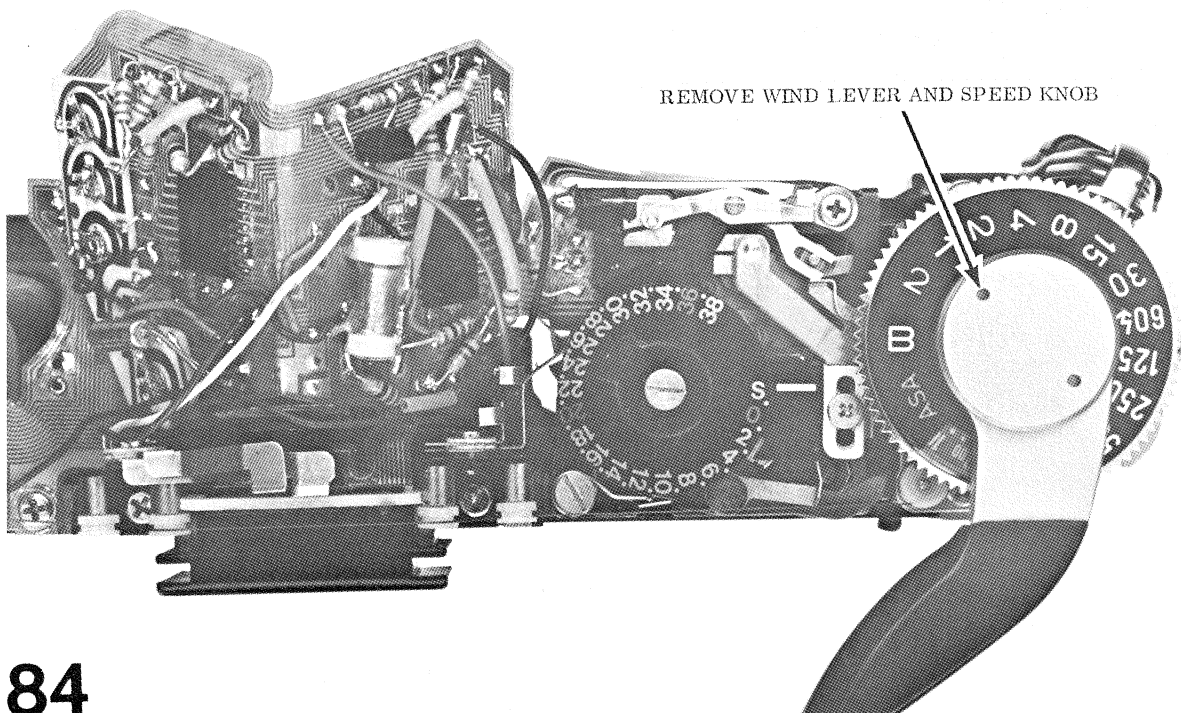
MAXIMUM-APERTURE
CORRECTION PIN
IS NOW LOOSE

83

STOP-DOWN SLIDE

STOP-DOWN
BLOCKING
LEVER

MANUAL
SWITCH
SW11

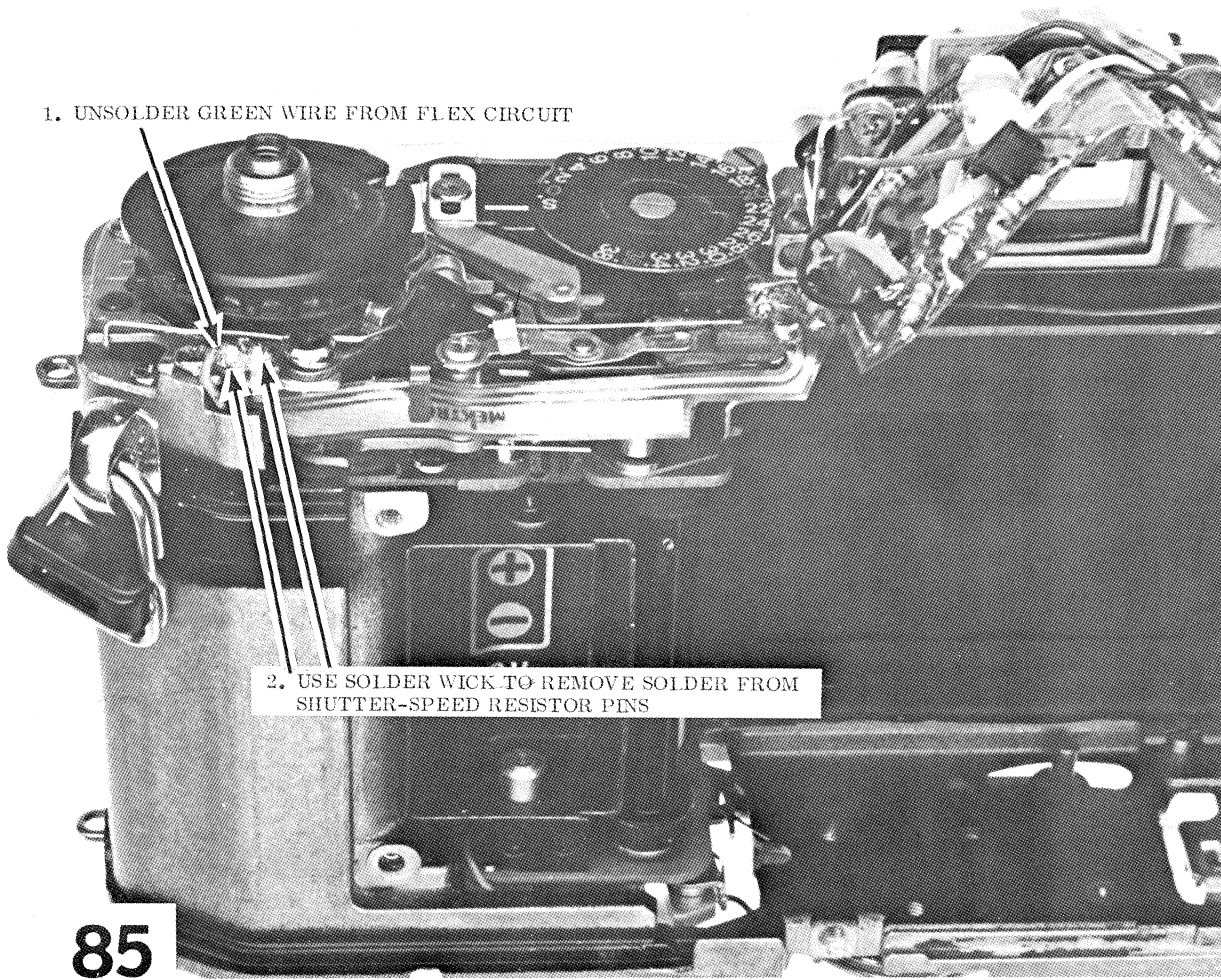


84

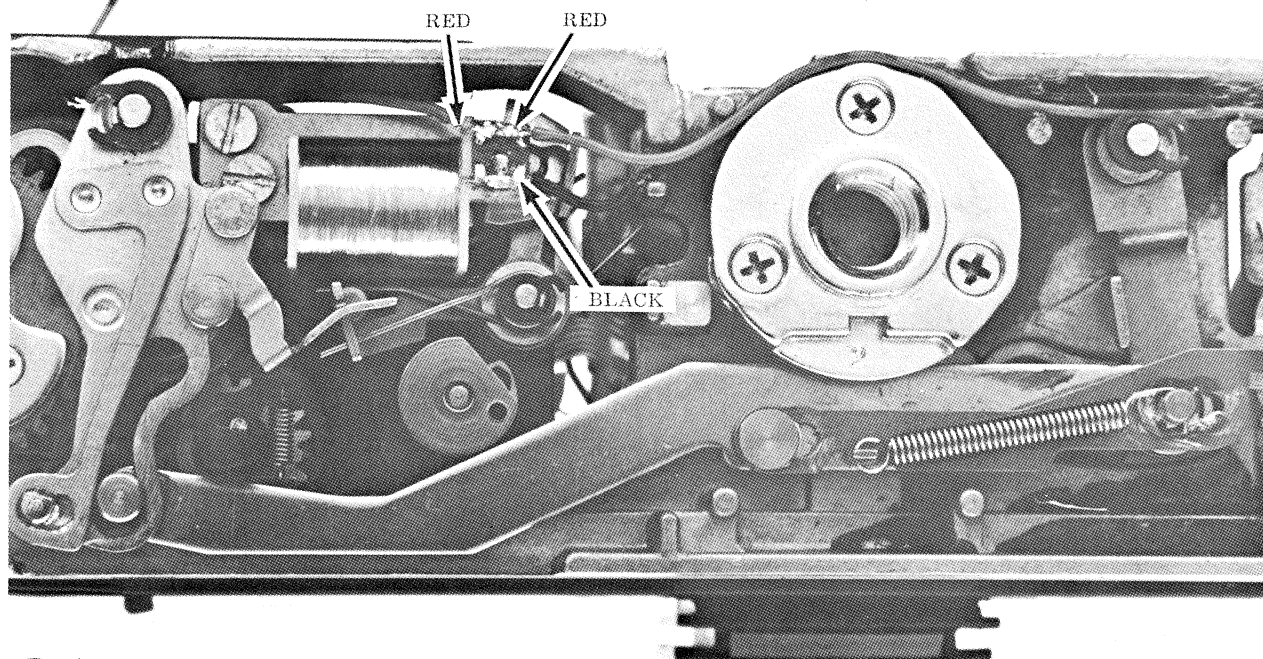
1. UNSOLDER GREEN WIRE FROM FLEX CIRCUIT

2. USE SOLDER WICK TO REMOVE SOLDER FROM SHUTTER-SPEED RESISTOR PINS

85

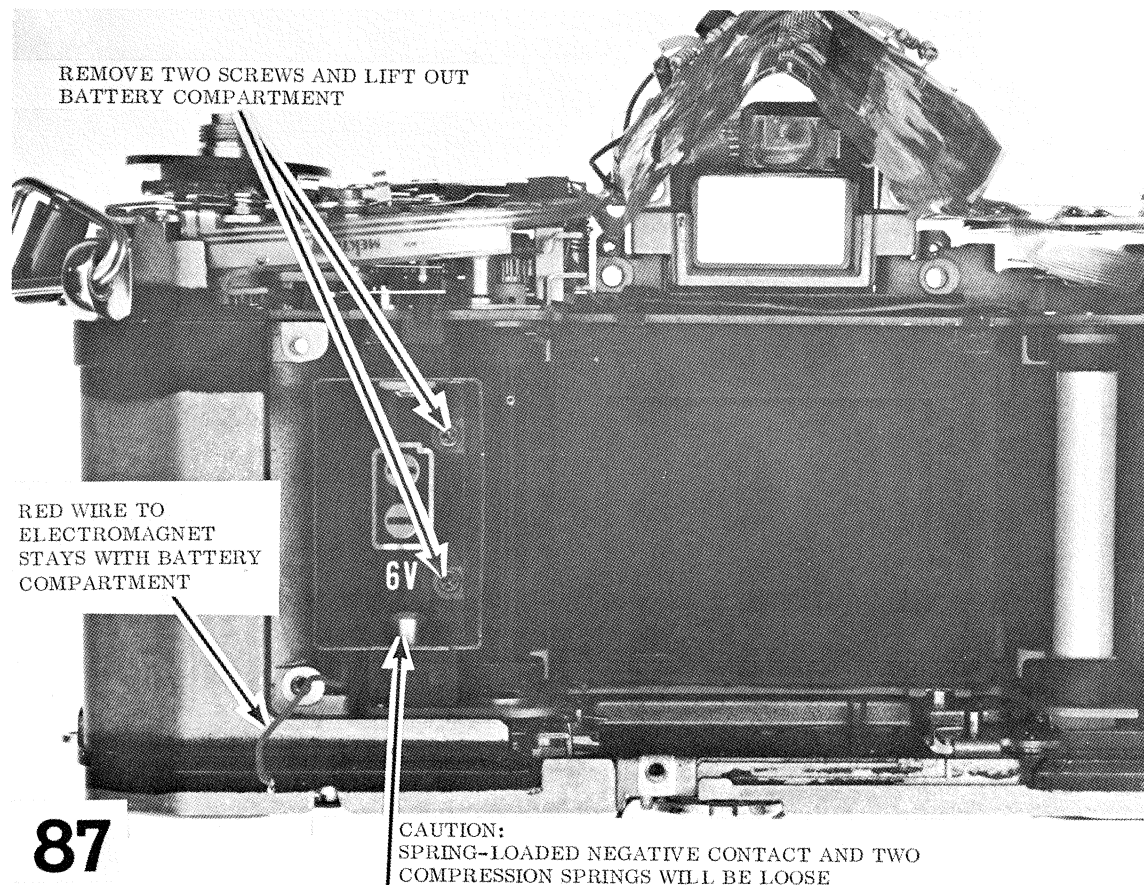


CAUTION: DO NOT ALLOW CAMERA TO LIE ON FLEX CIRCUIT



86

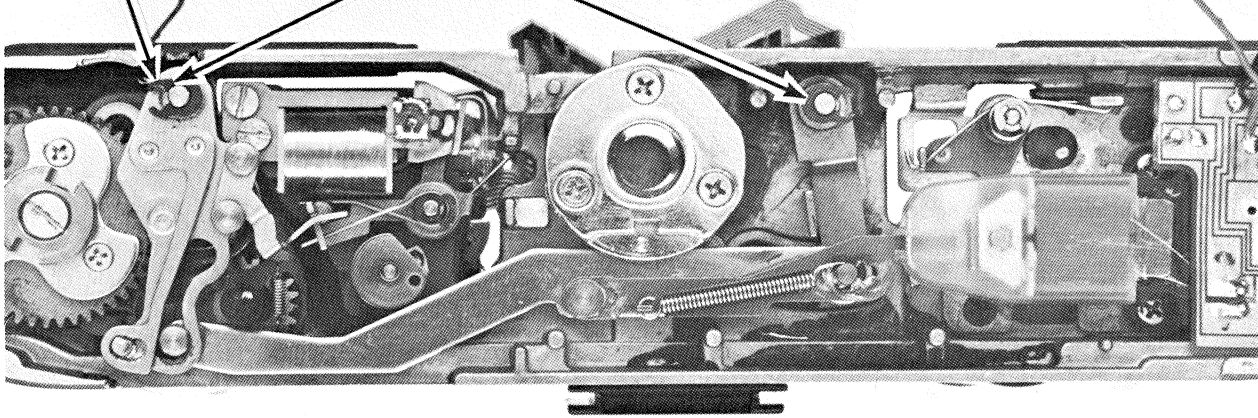
UNSOLDER WIRES FROM CLOSING-CURTAIN MAGNET Mg3



1. REMOVE TRIPOD SOCKET

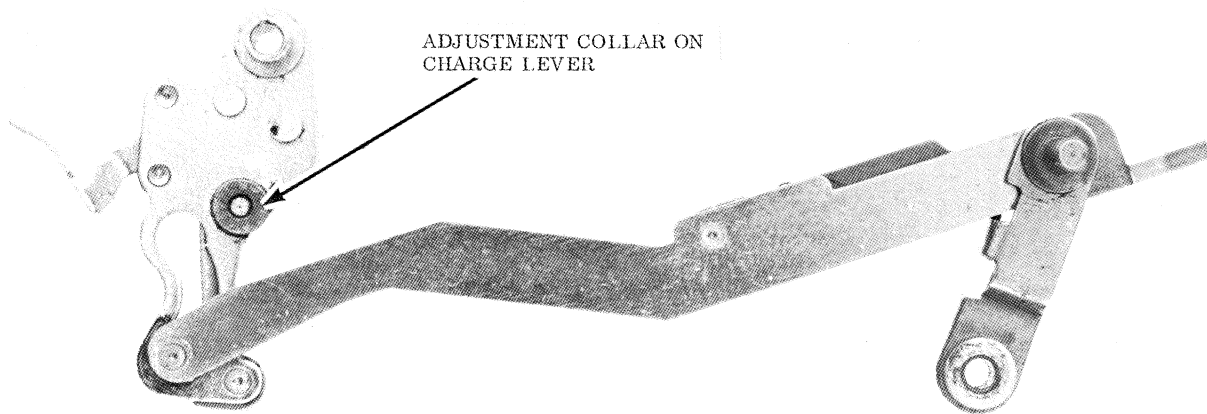
2. REMOVE SNAP RINGS AND LIFT OUT CHARGE
LEVER

MOST CAMERAS
HAVE E-RING ON
THIS SIDE



88

CAUTION: ADJUSTMENT COLLAR ON UNDERSIDE
OF CHARGE LEVER IS LOOSE

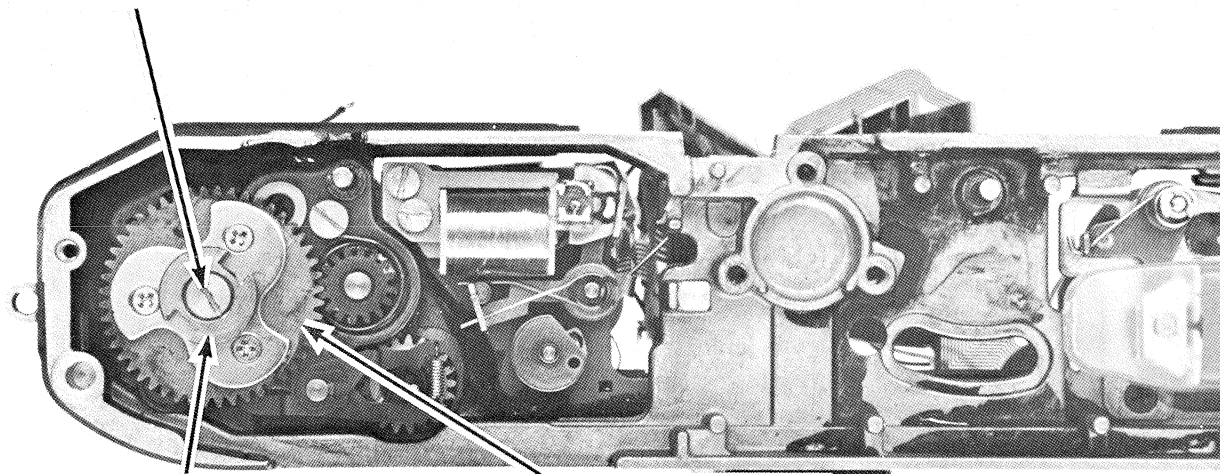


ADJUSTMENT COLLAR ON
CHARGE LEVER

ADJUSTMENT COLLAR DIAMETERS:

3.4mm
3.6mm
3.8mm
4.0mm
4.2mm

1. REMOVE SCREW



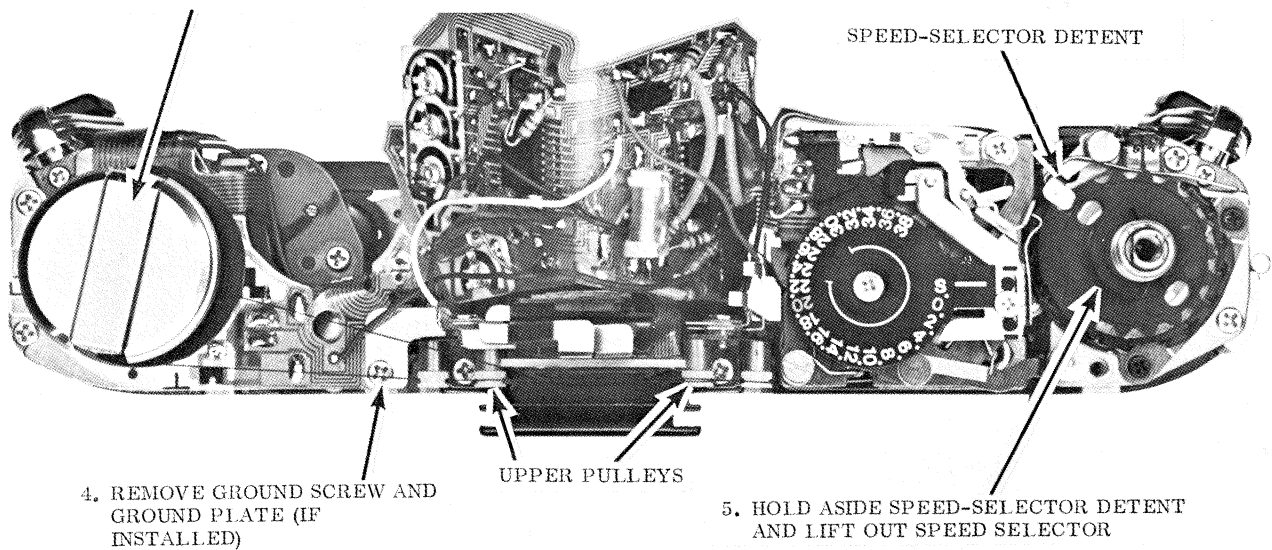
2. LIFT OUT WIND COUPLER

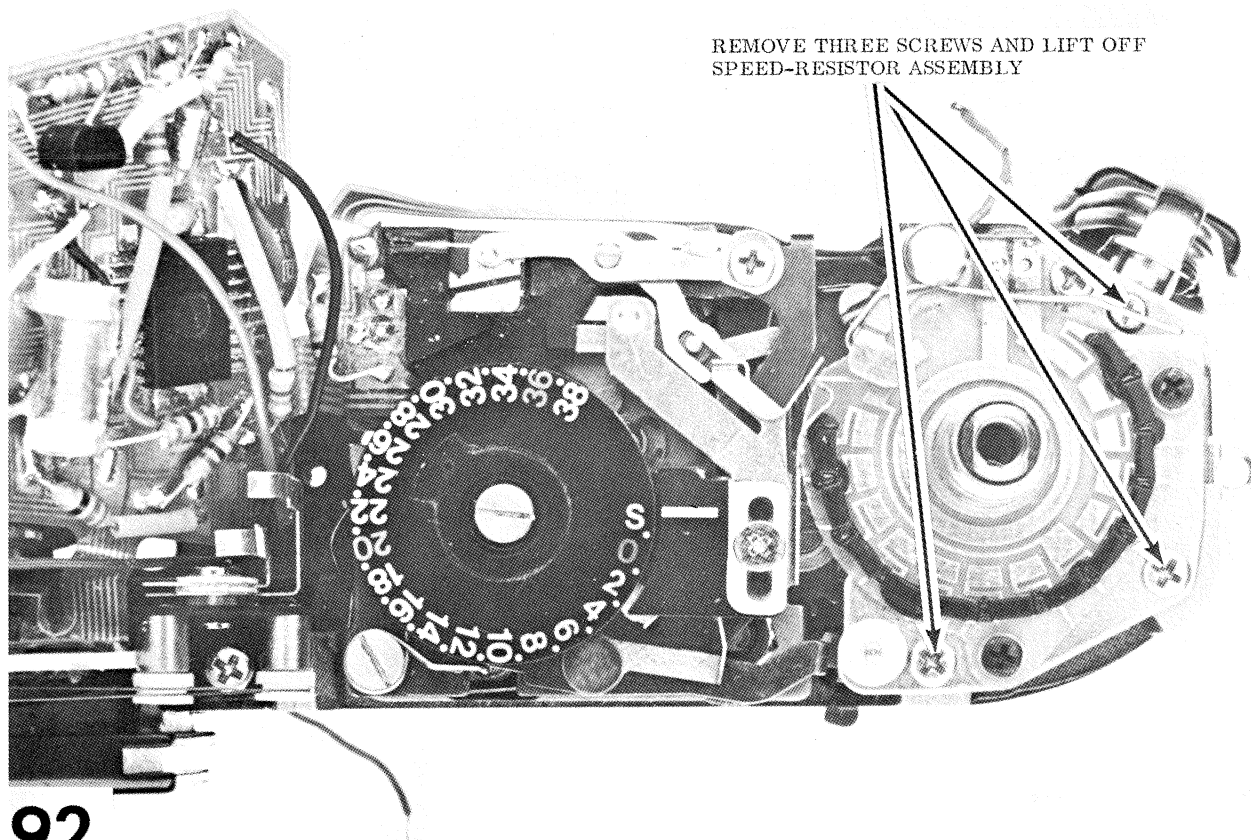
3. LIFT OUT WIND GEAR

90

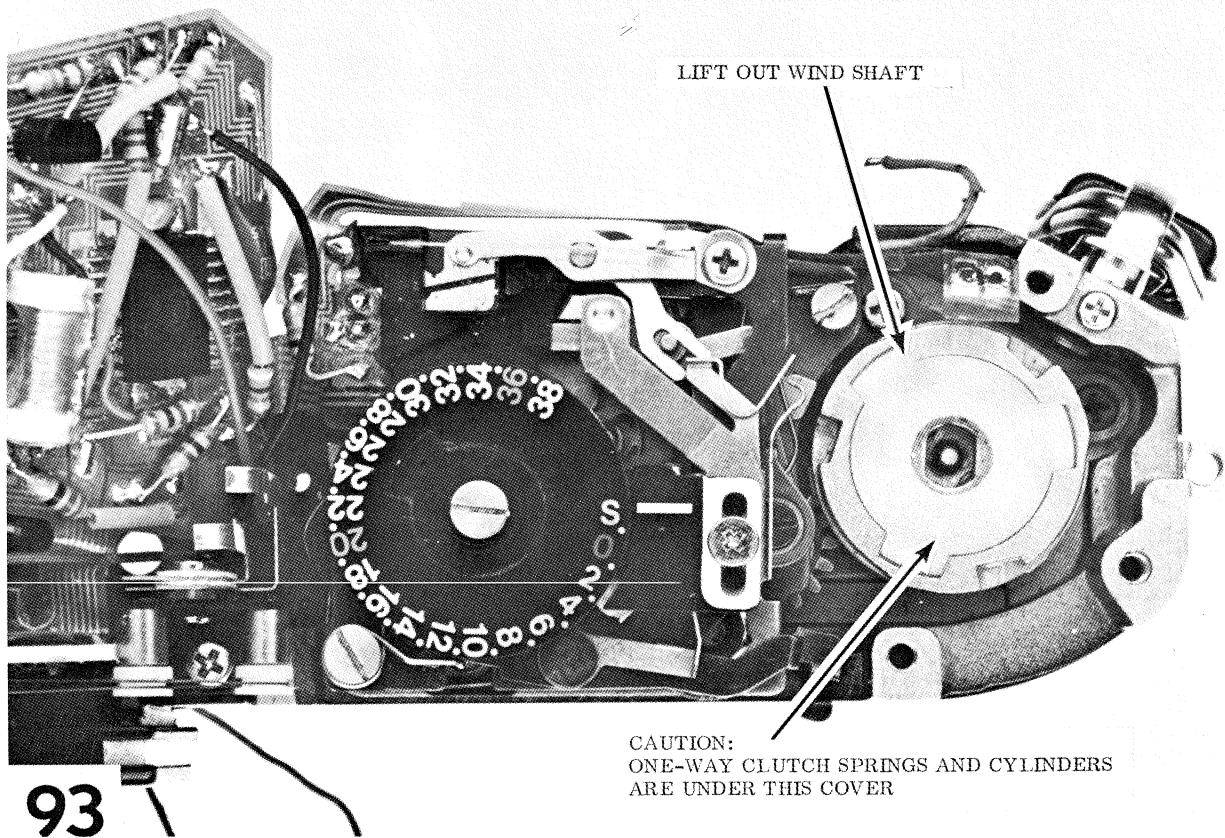
NOTE TIMING OF CHARGE CAM

1. LIFT OFF SPEED-KNOB COUPLER WITHOUT LOSING INITIAL TENSION ON FUNCTIONAL RESISTOR
2. ROUTE TUNGSTEN WIRE OVER TOP OF UPPER PULLEYS -- PLACE SPEED-KNOB COUPLER OVER REWIND-SHAFT HOUSING
3. REPLACE REWIND KNOB TO HOLD SPEED-KNOB COUPLER IN PLACE





REMOVE THREE SCREWS AND LIFT OFF
SPEED-RESISTOR ASSEMBLY

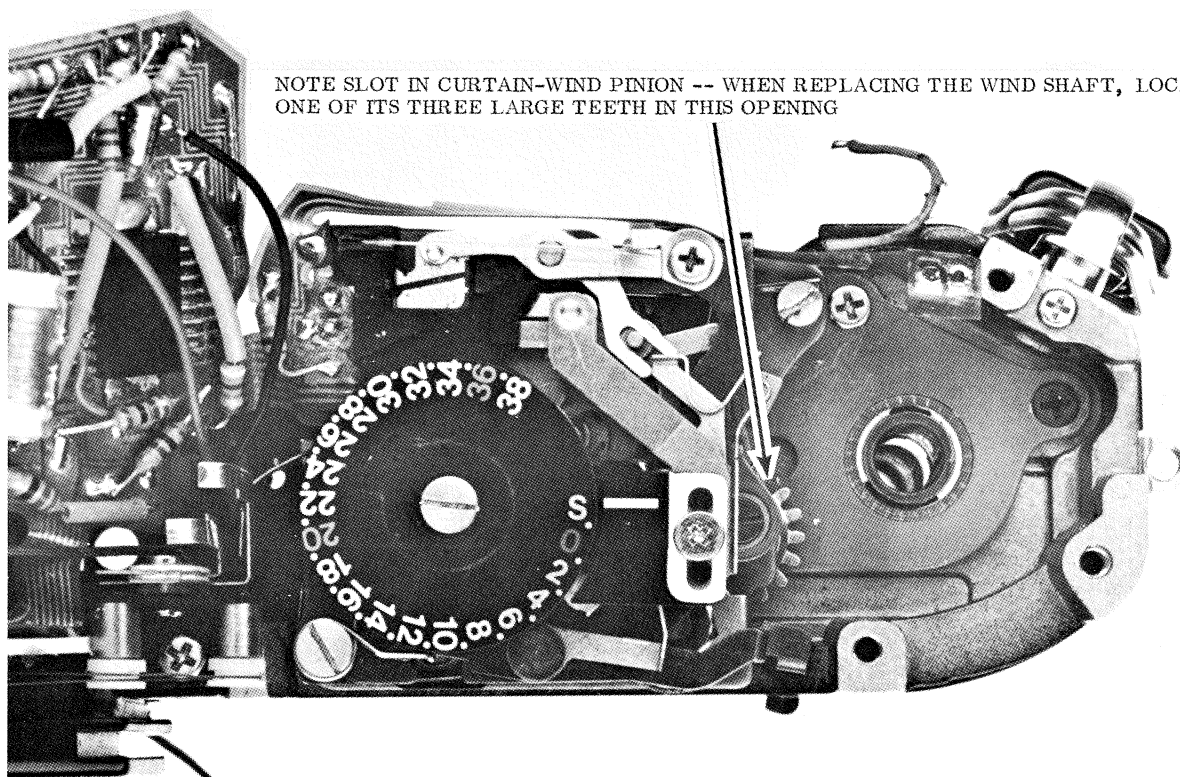


LIFT OUT WIND SHAFT

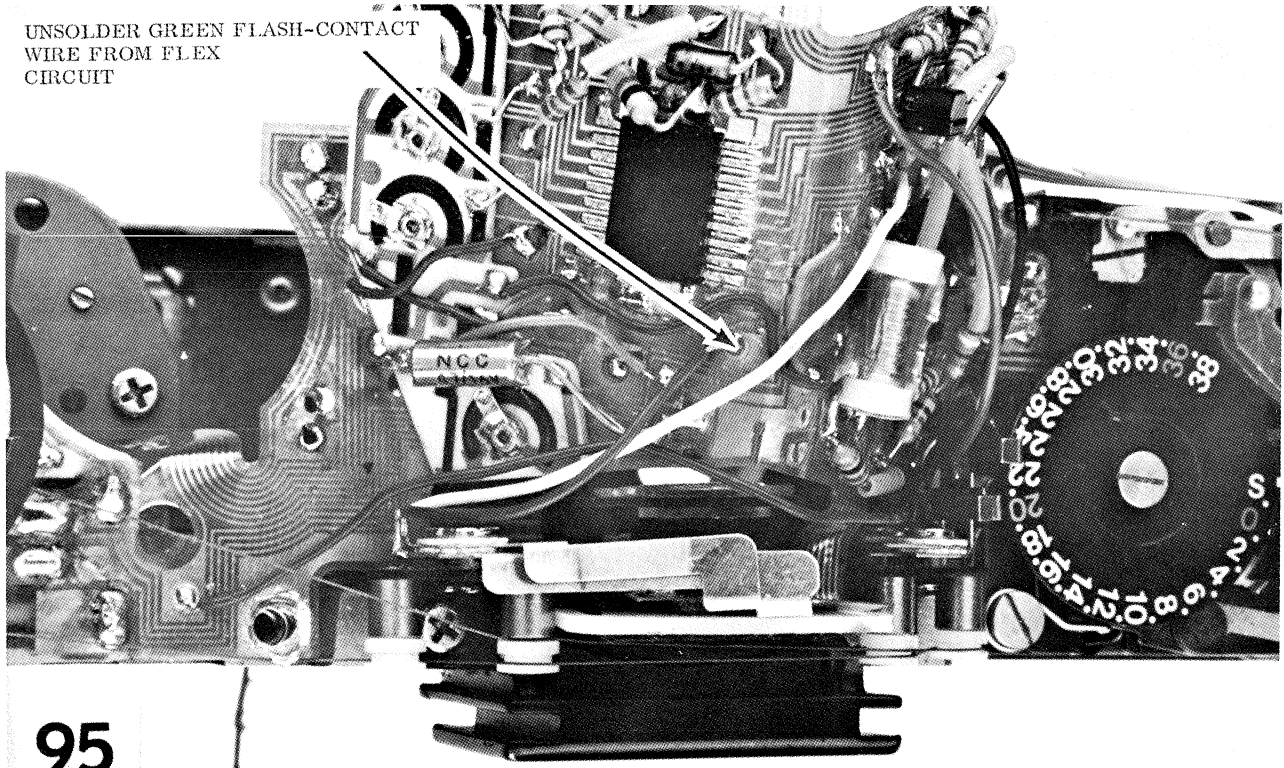
CAUTION:
ONE-WAY CLUTCH SPRINGS AND CYLINDERS
ARE UNDER THIS COVER

93

NOTE SLOT IN CURTAIN-WIND PINION -- WHEN REPLACING THE WIND SHAFT, LOCATE ONE OF ITS THREE LARGE TEETH IN THIS OPENING



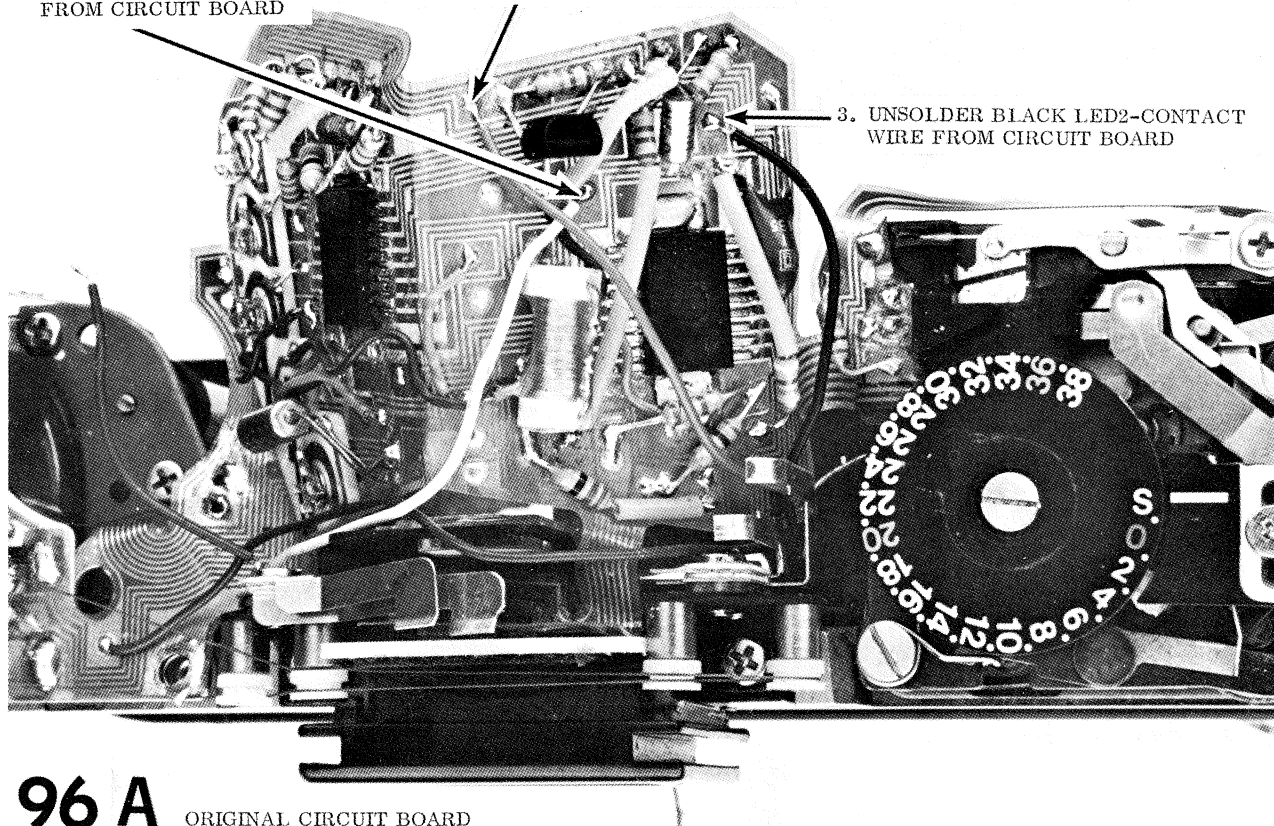
UNSOLDER GREEN FLASH-CONTACT
WIRE FROM FLEX
CIRCUIT



1. UNSOLDER WHITE
FLASH-CONTACT WIRE
FROM CIRCUIT BOARD

2. UNSOLDER RED LED2-CONTACT
WIRE FROM CIRCUIT BOARD

3. UNSOLDER BLACK LED2-CONTACT
WIRE FROM CIRCUIT BOARD

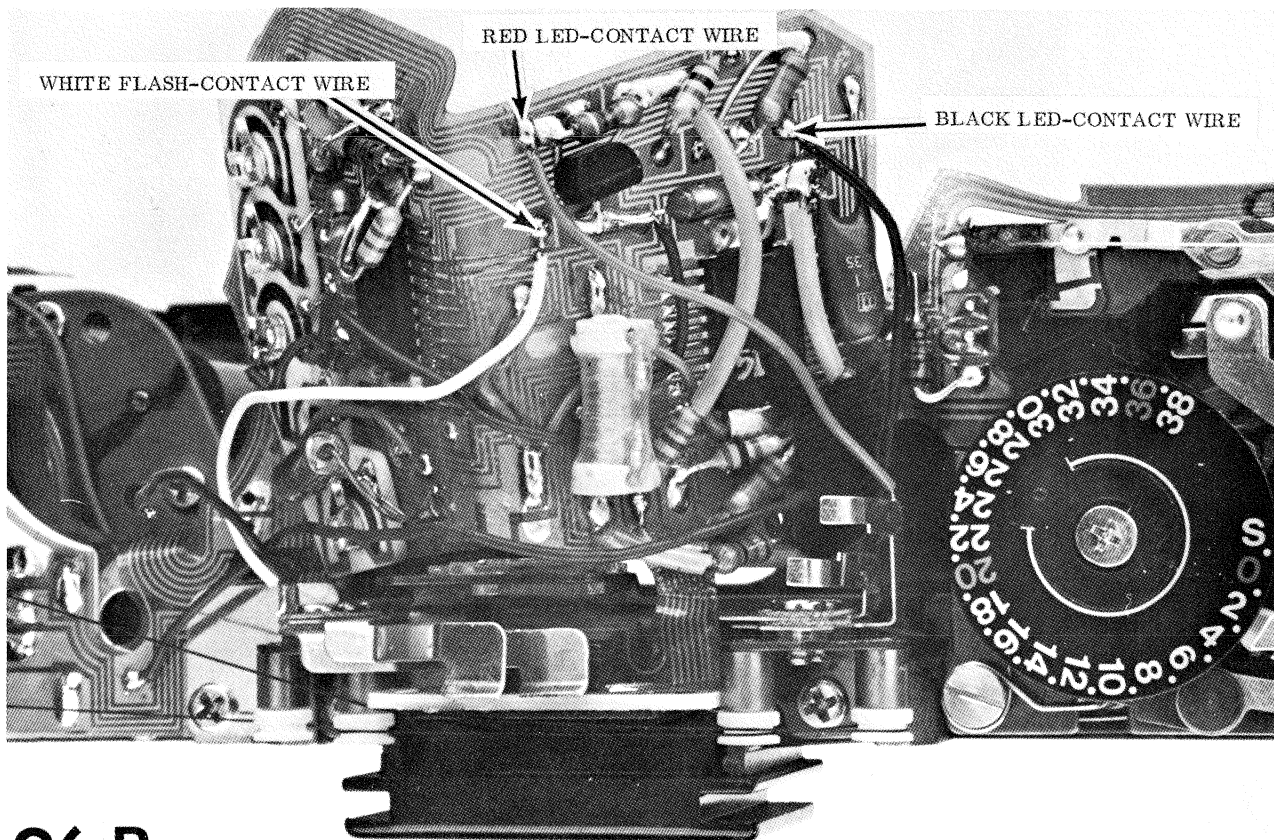


96 A ORIGINAL CIRCUIT BOARD

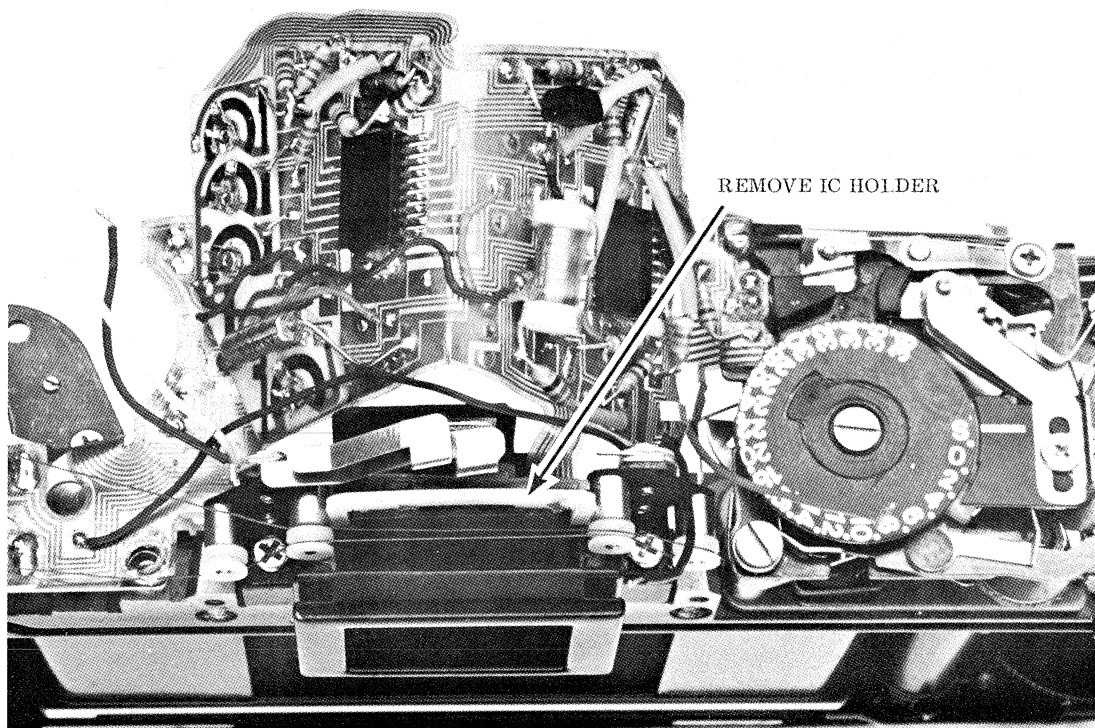
WHITE FLASH-CONTACT WIRE

RED LED-CONTACT WIRE

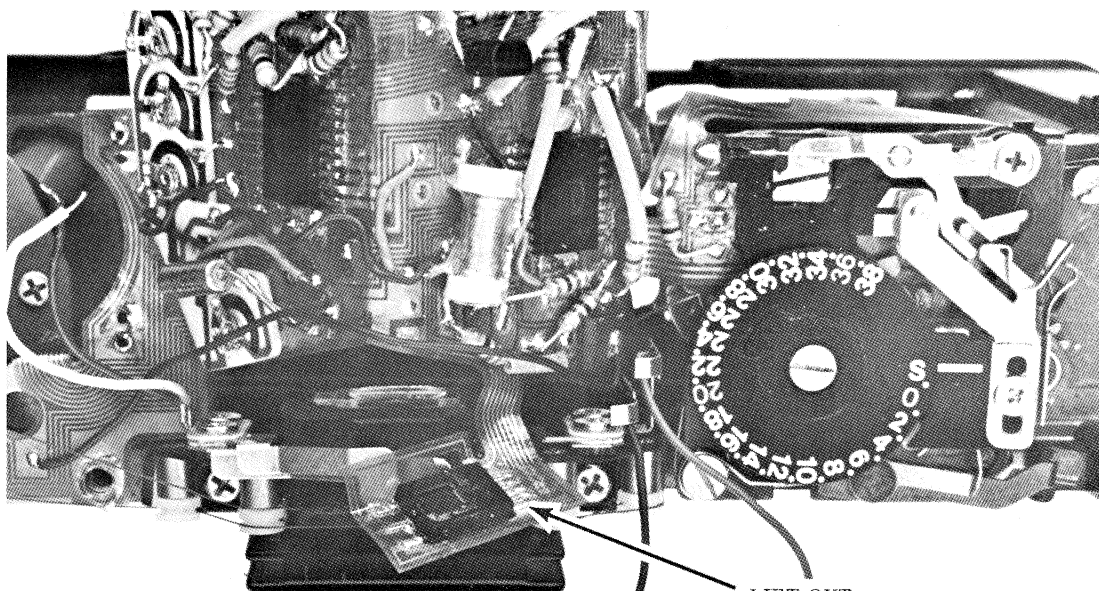
BLACK LED-CONTACT WIRE



96 B MODIFIED CIRCUIT BOARD



97



LIFT OUT
MOS IC
PX1

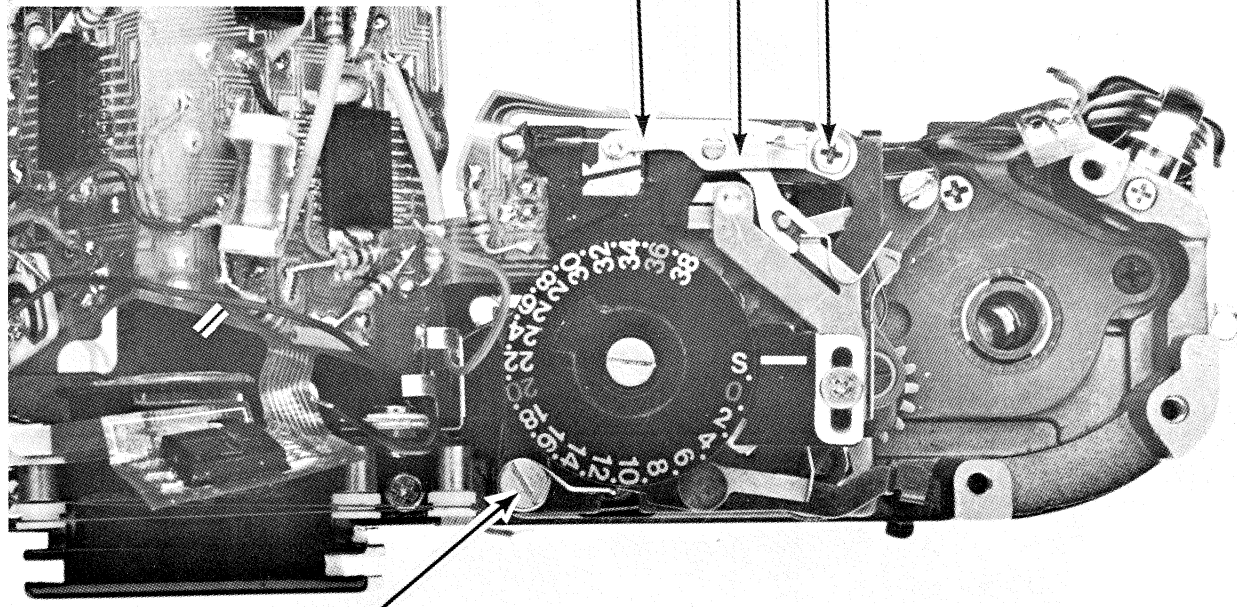
98

1. REMOVE SCREW

2. LIFT OUT SW5 CONTACT HOLDER

3. LIFT OUT SW5 CONTACT BLADE

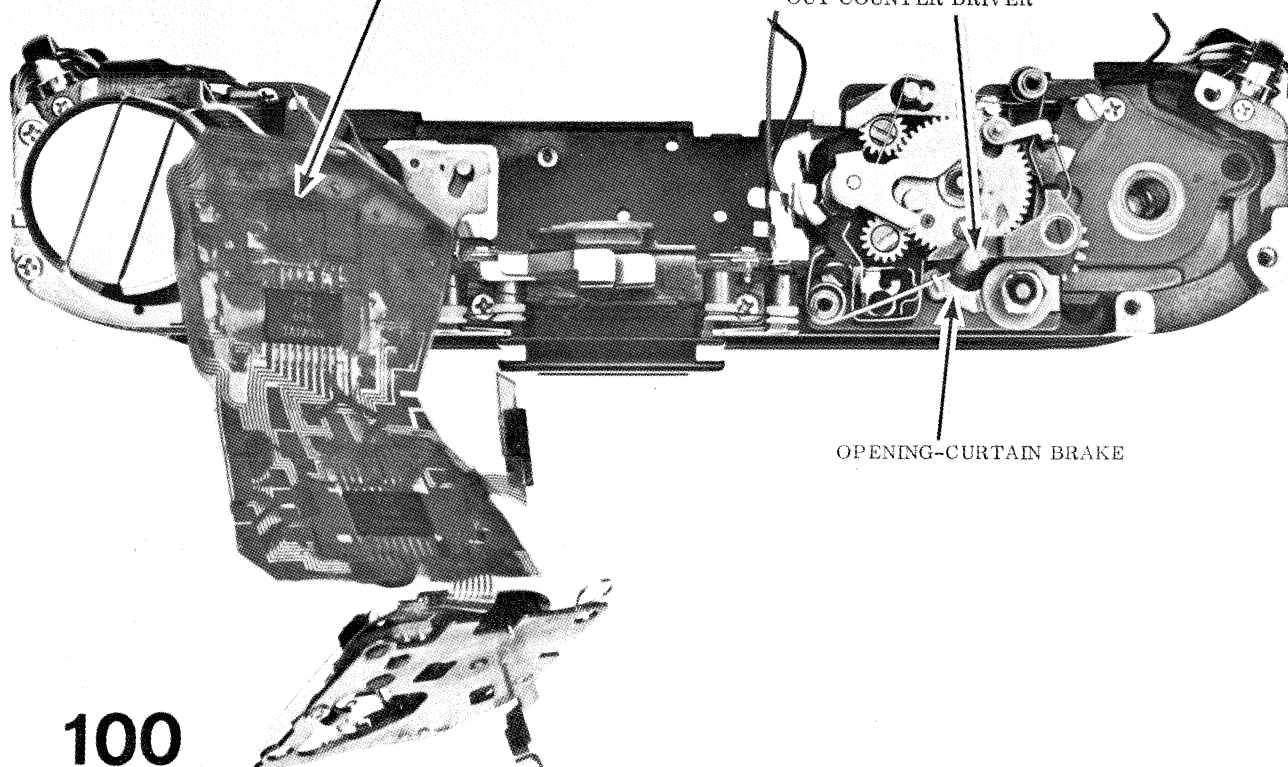
(THERE MAY BE A WASHER
BETWEEN THE HOLDER AND BLADE)



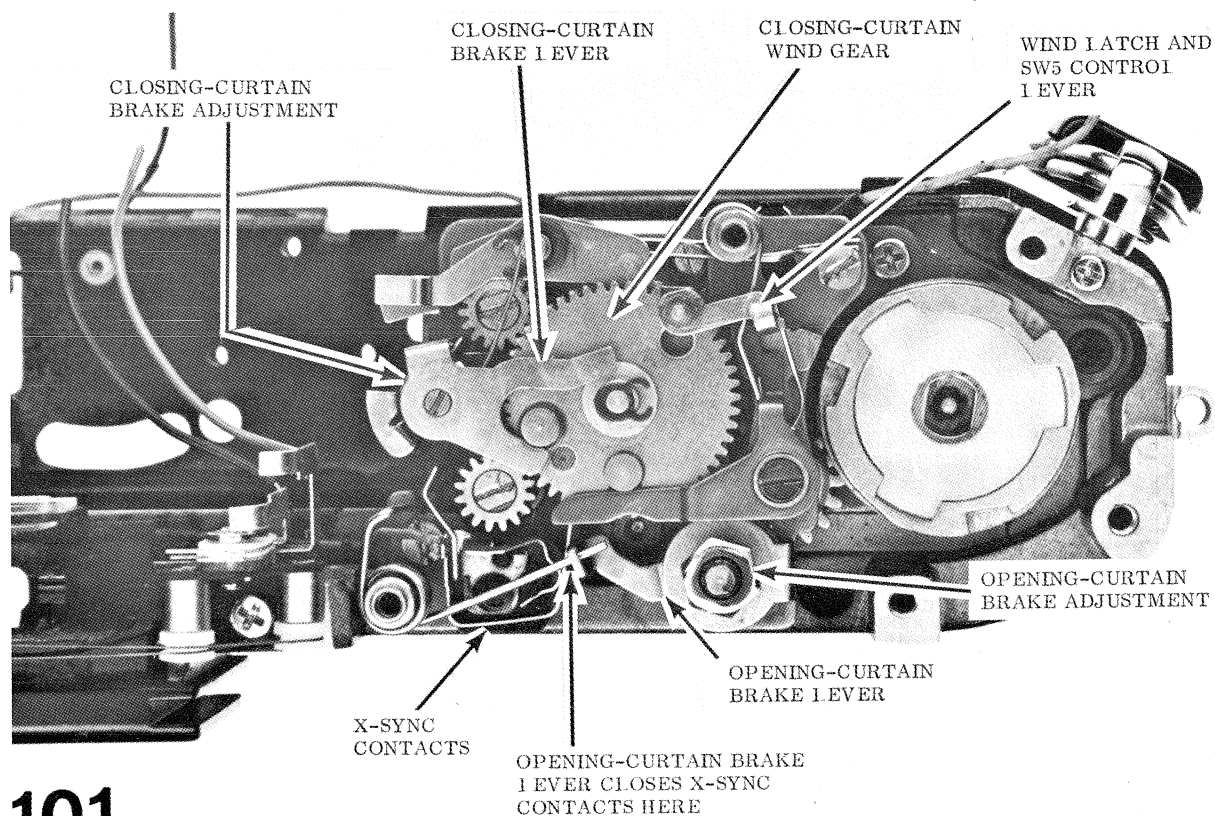
4. REMOVE SHOULDER SCREW -- COUNTER-RETURN-LEVER SPRING SHOULD STAY
ON COUNTER PLATE

1. LIFT ASIDE FLEX CIRCUIT

2. PUSH OPENING-CURTAIN BRAKE
TOWARD BACK OF CAMERA AND LIFT
OUT COUNTER DRIVER

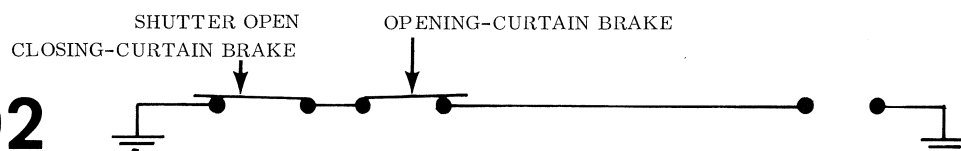
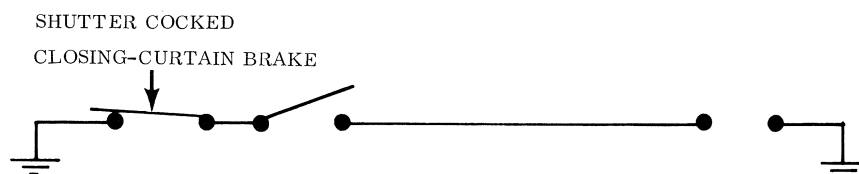
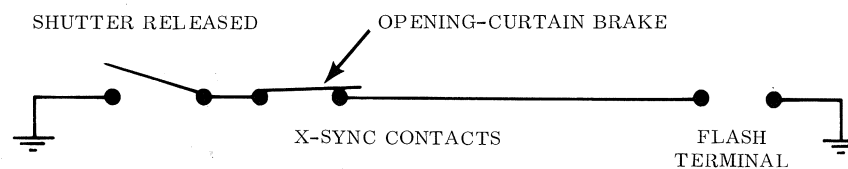
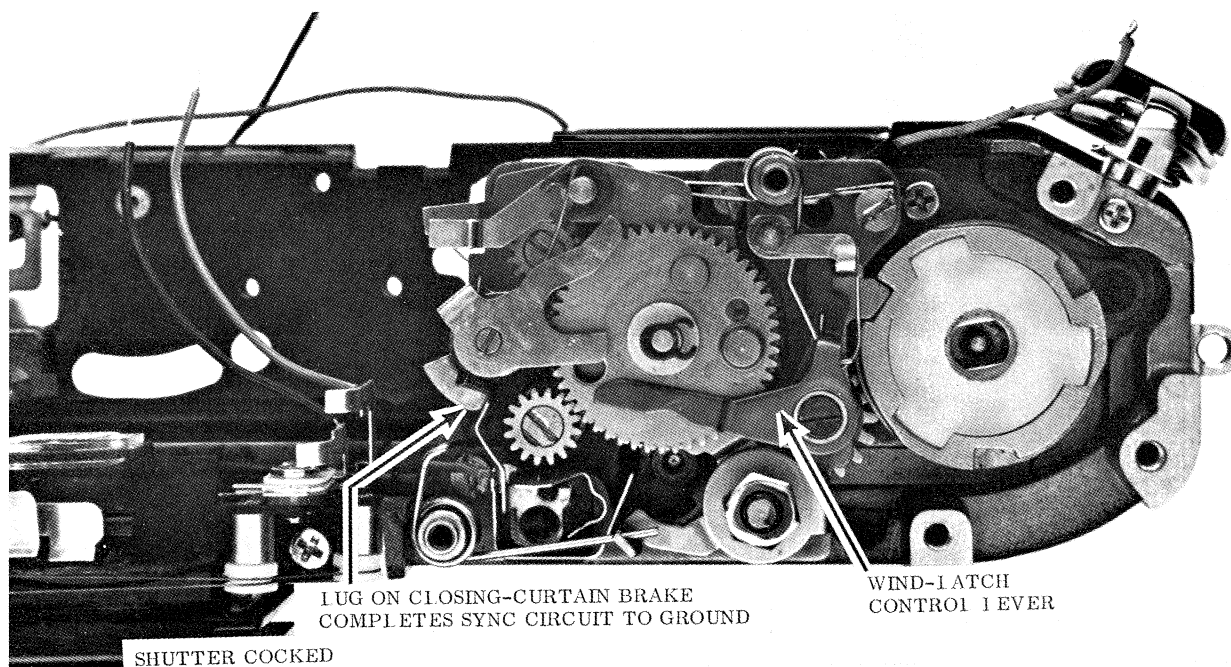


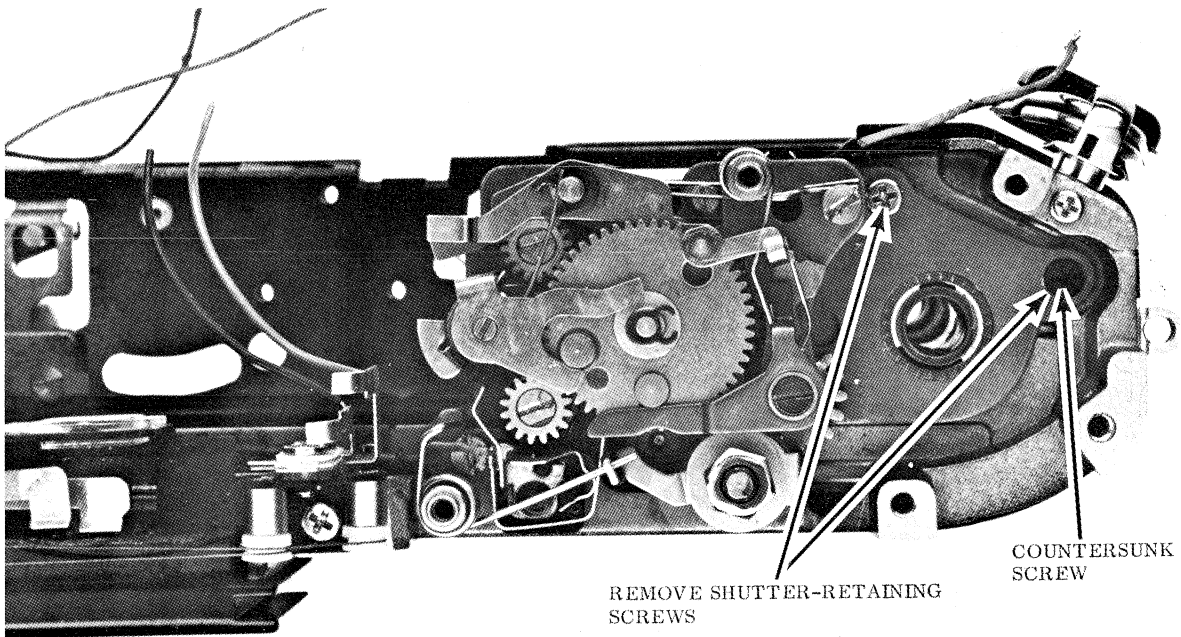
100



101

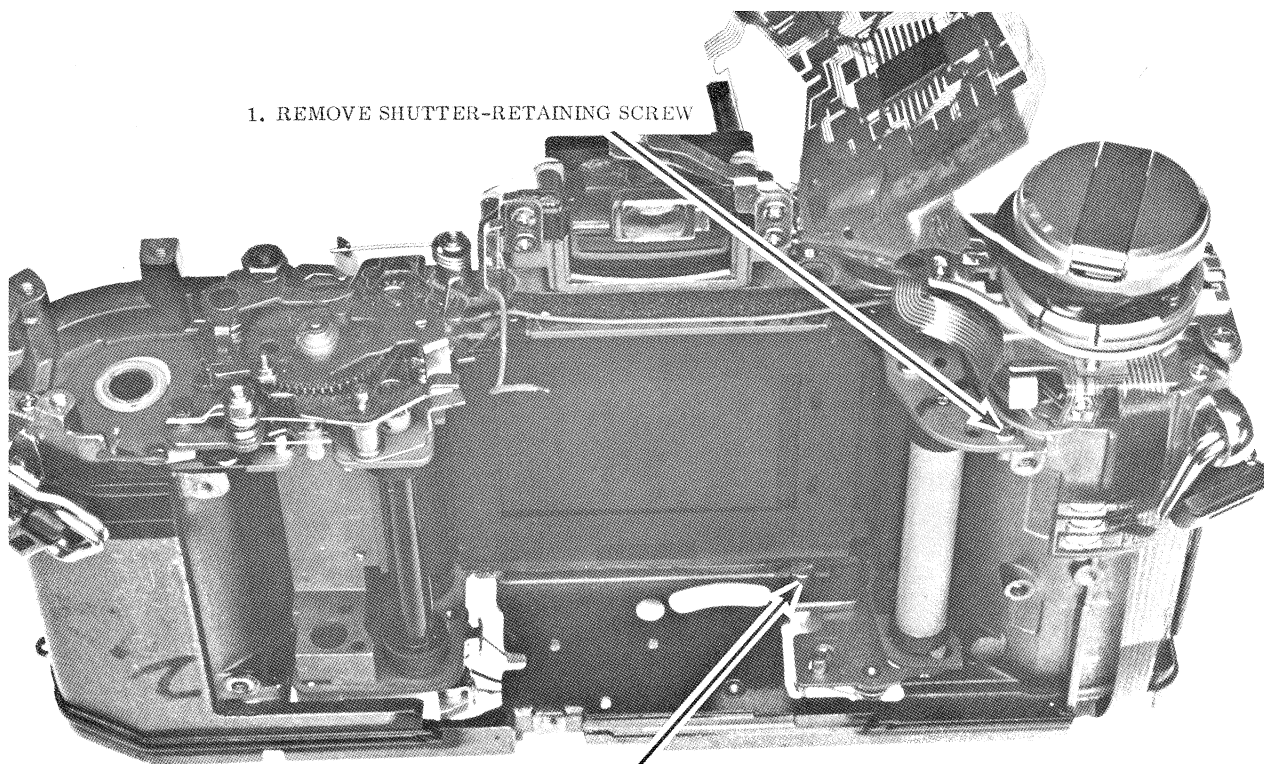
SHUTTER RELEASED





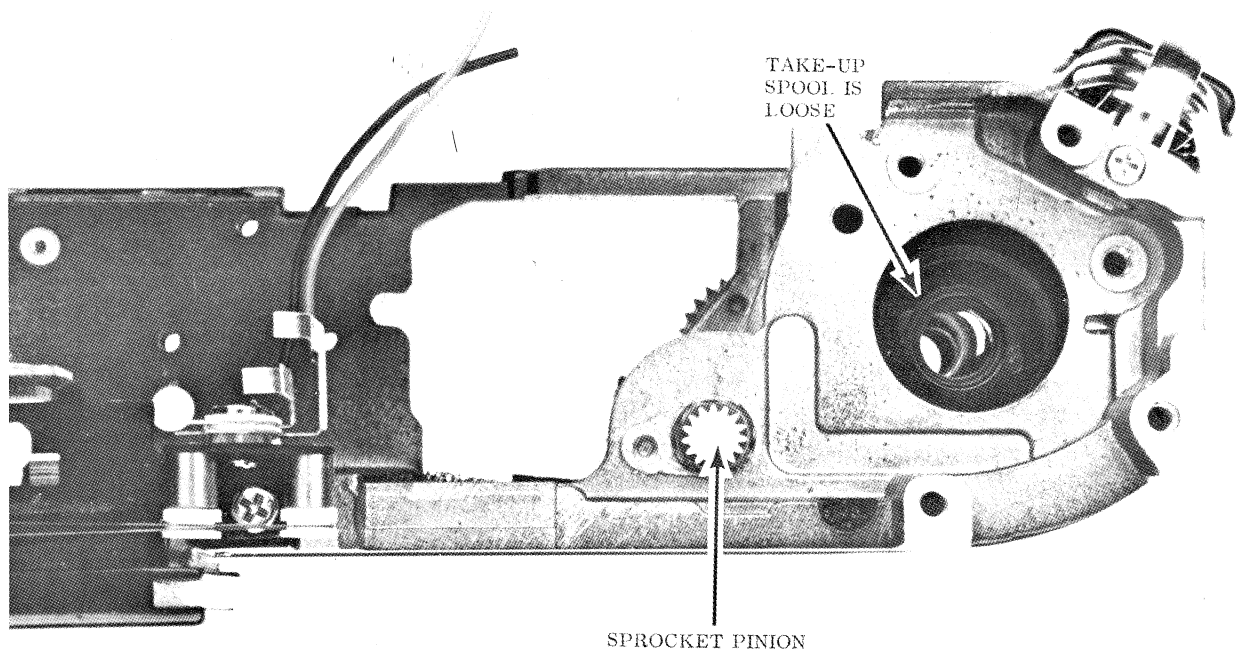
103

1. REMOVE SHUTTER-RETAINING SCREW

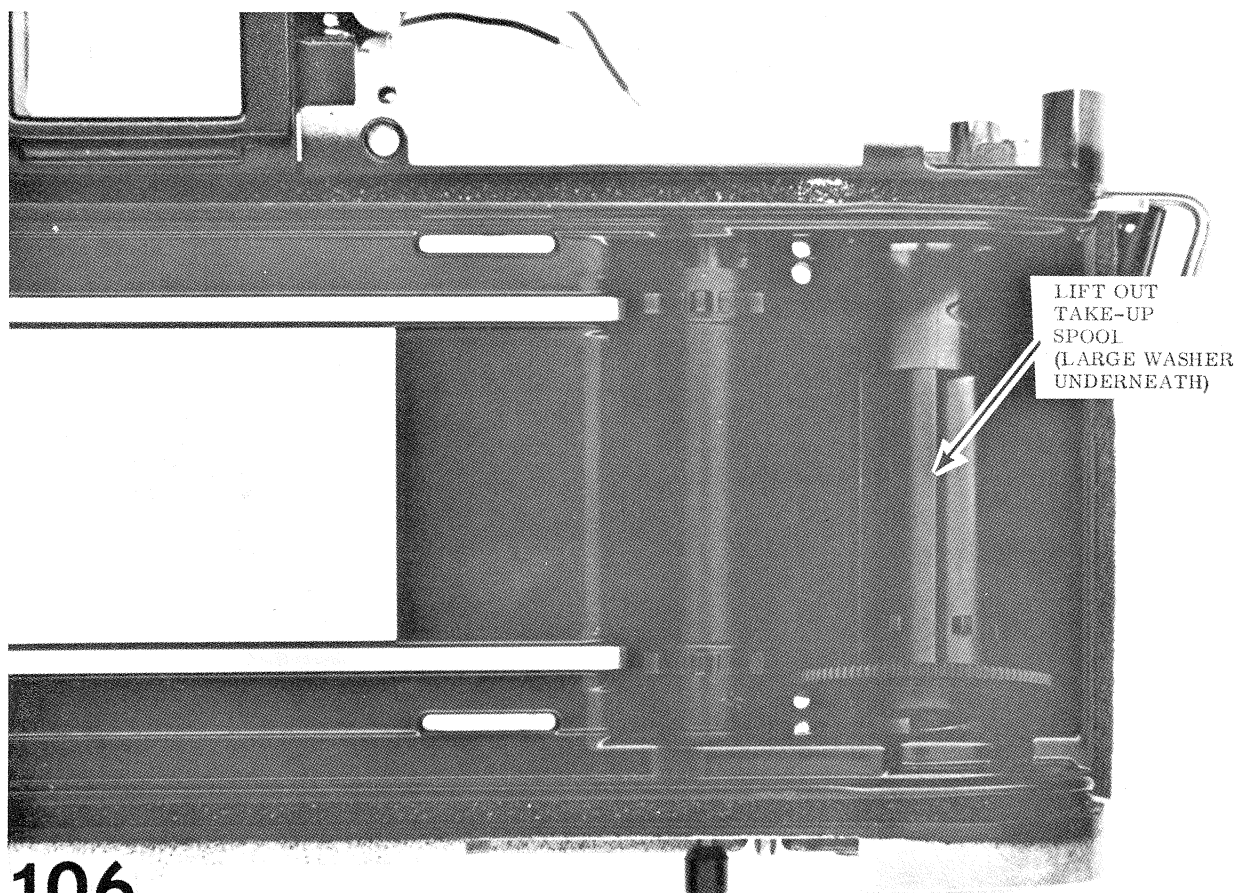


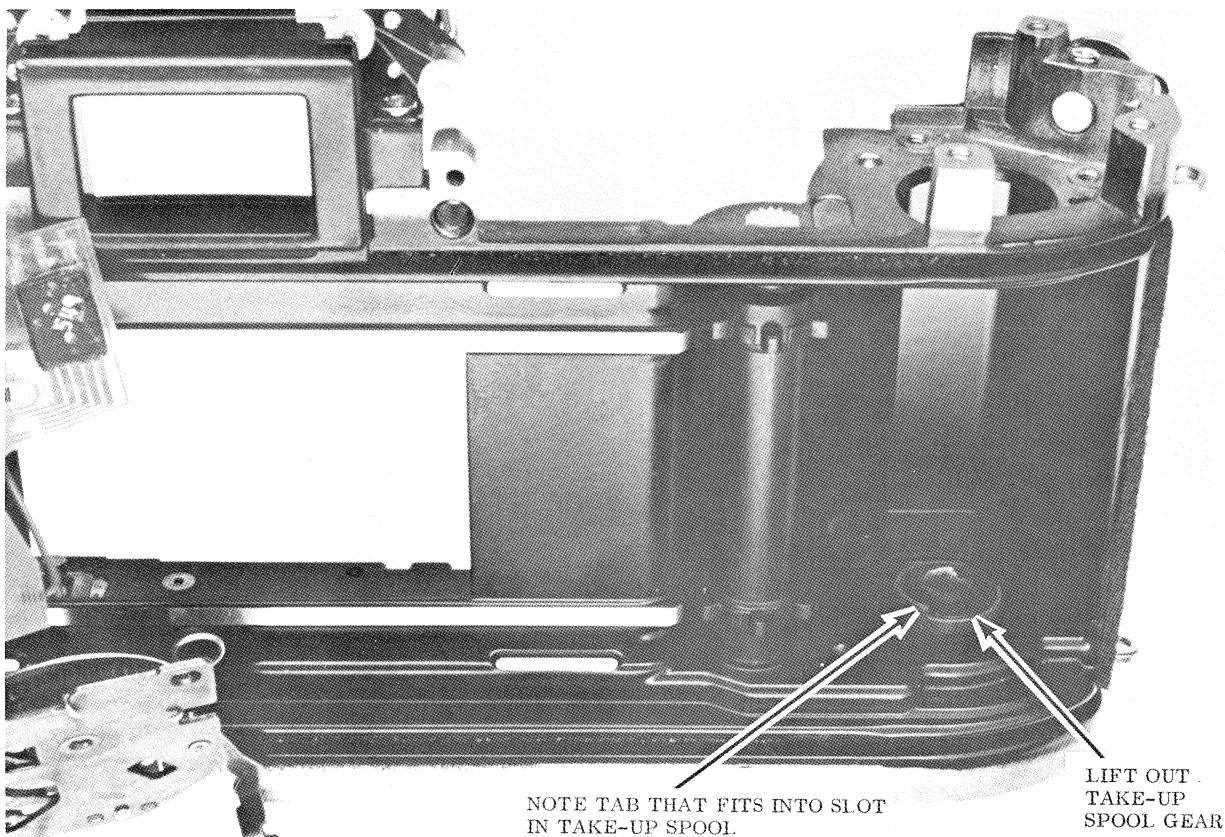
2. REMOVE SHUTTER-POSITIONING SCREW

3. LIFT OUT SHUTTER MODULE



105





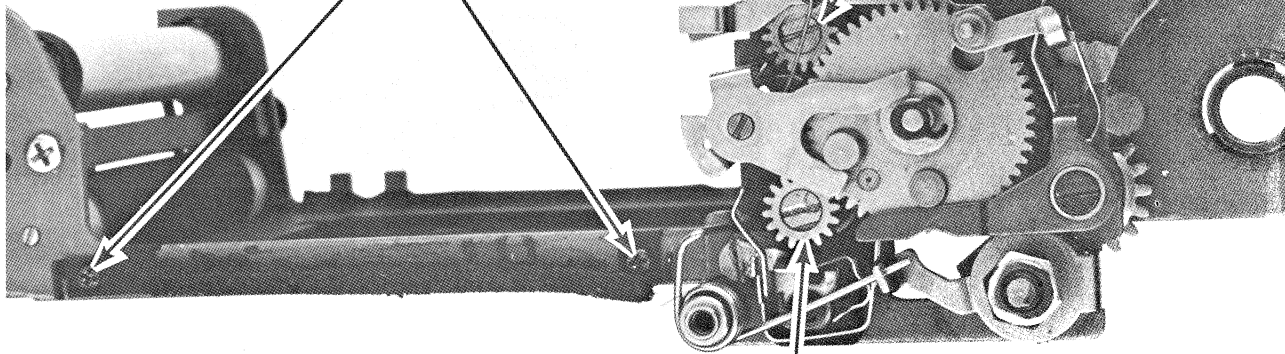
NOTE TAB THAT FITS INTO SLOT
IN TAKE-UP SPOOL

LIFT OUT
TAKE-UP
SPOOL GEAR

107

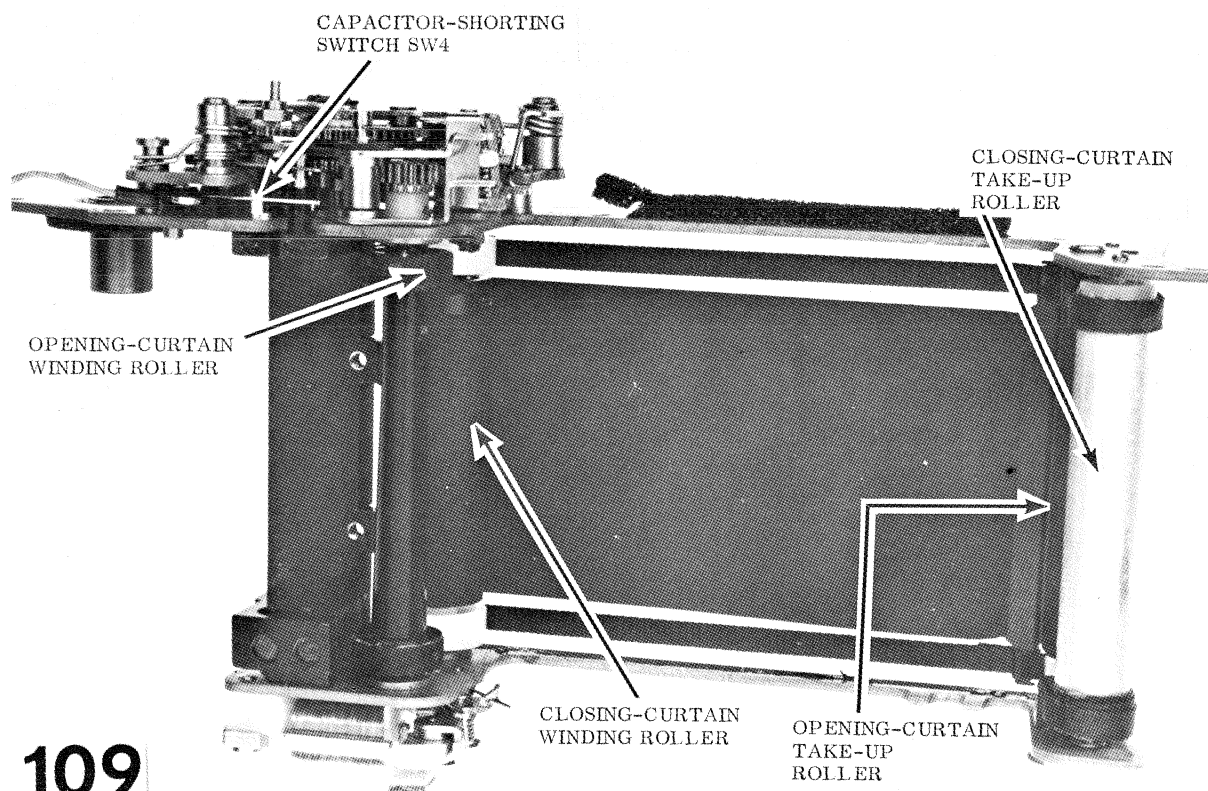
TAKE OUT TWO SCREWS TO REMOVE
CURTAIN-COVER PLATE

OPENING-CURTAIN
WINDING-ROLLER
PINION

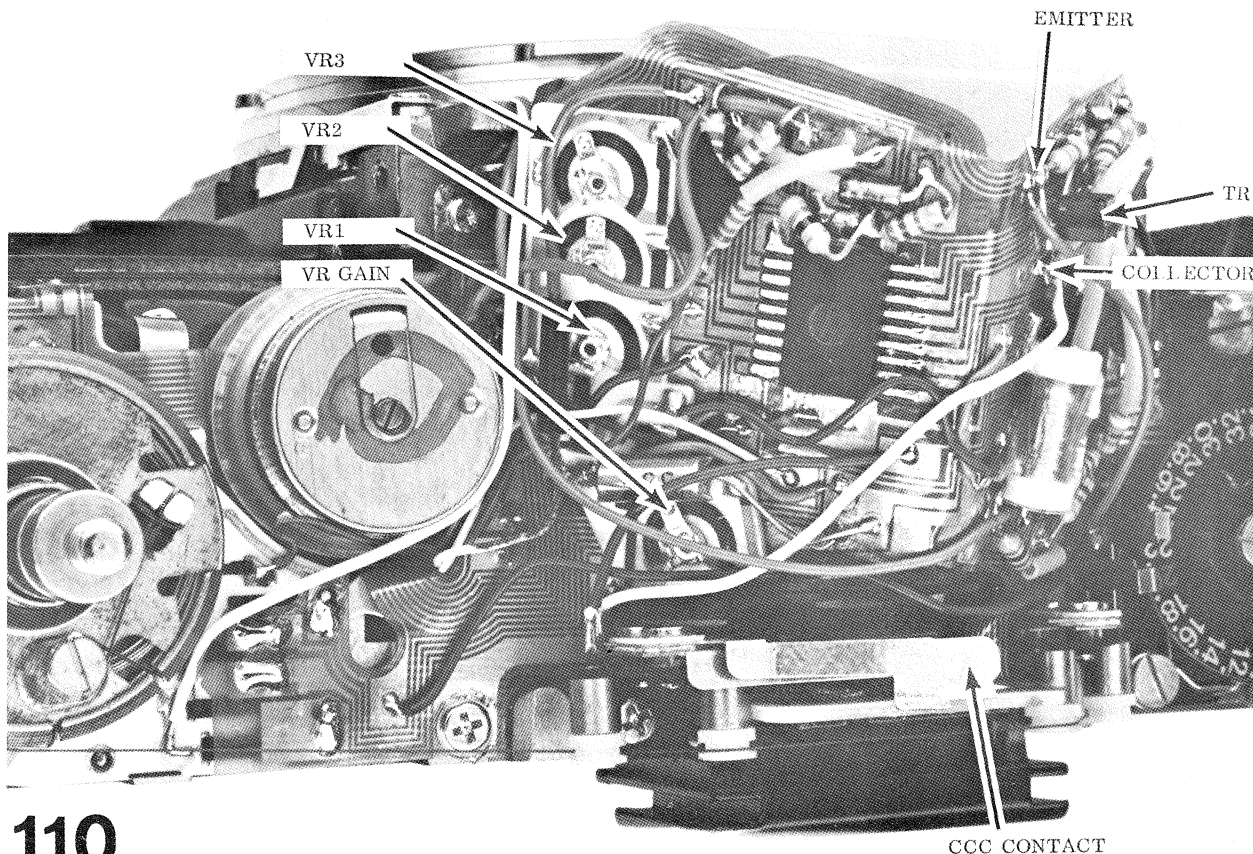


108

CLOSING-CURTAIN
WINDING-ROLLER
PINION

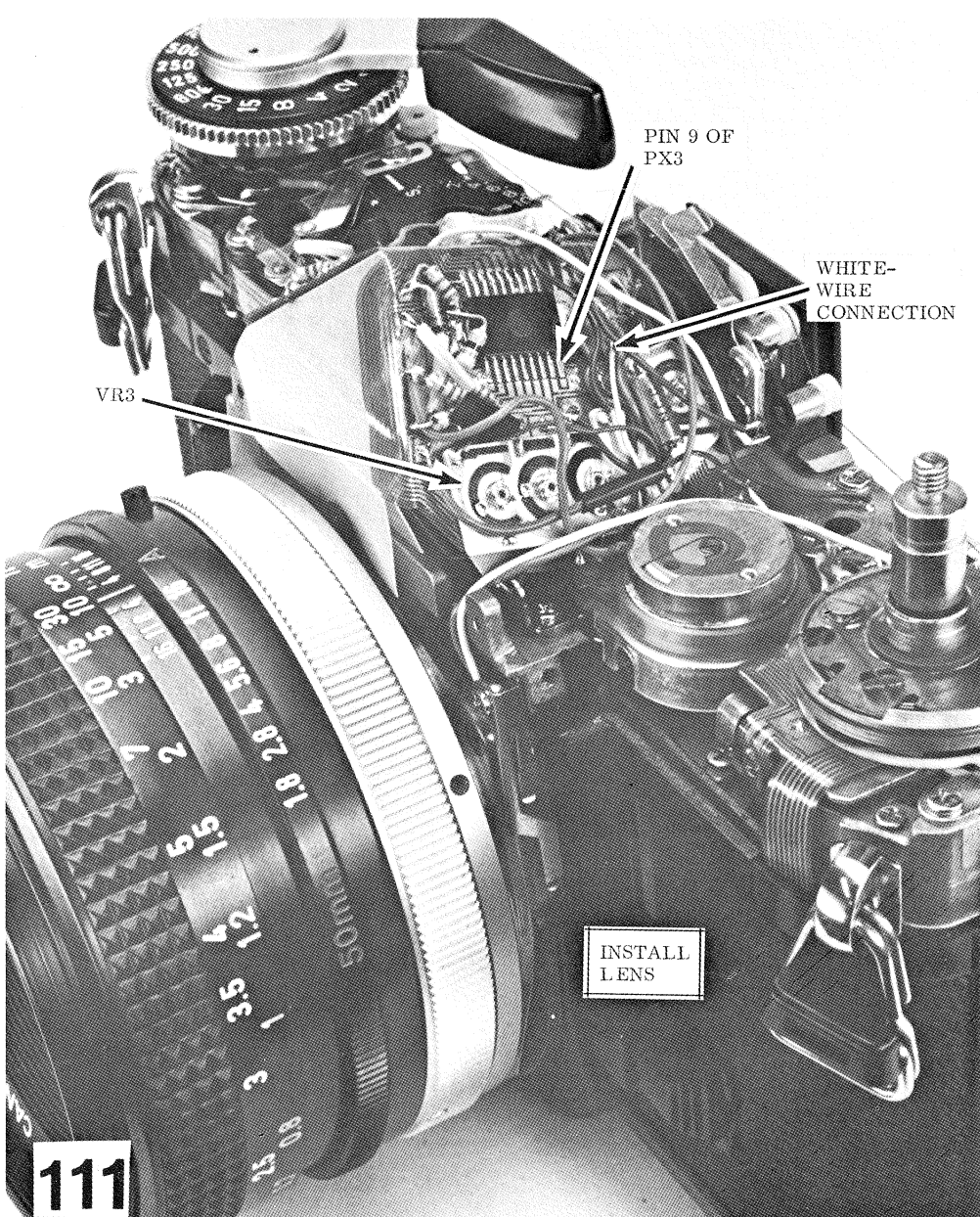


109



110

1. Test the supply voltage by measuring between ground (negative) and the emitter of the discrete transistor TR without closing SW1. You should measure the full battery voltage (around 6.35 volts). You should also measure the full battery voltage at the base of TR. At the collector of TR, you should measure 0 volt.
2. Use a mini-clip to hold switch SW1 closed. You should now measure voltage E1 at the collector of the discrete transistor. This voltage will be slightly less than the battery voltage -- around 5.5 volts (the difference between the battery voltage and the voltage dropped across the transistor).
3. Check the V_c voltage between ground and the CCC contact (the lower, longer of the two flash contacts). With SW1 closed, you should measure $1.2 \text{ volts} \pm 0.06 \text{ volt}$. A voltage regulator maintains V_c at a constant level despite variations in battery voltage. But V_c varies slightly from camera to camera. You'll use the V_c voltage in your particular camera as a reference in making the other voltage adjustments. So record your V_c voltage measurement.



ADJUSTMENTS

1. AVO (maximum-aperture correction) ADJUSTMENT

Use the following formula to calculate what your AVO should be:

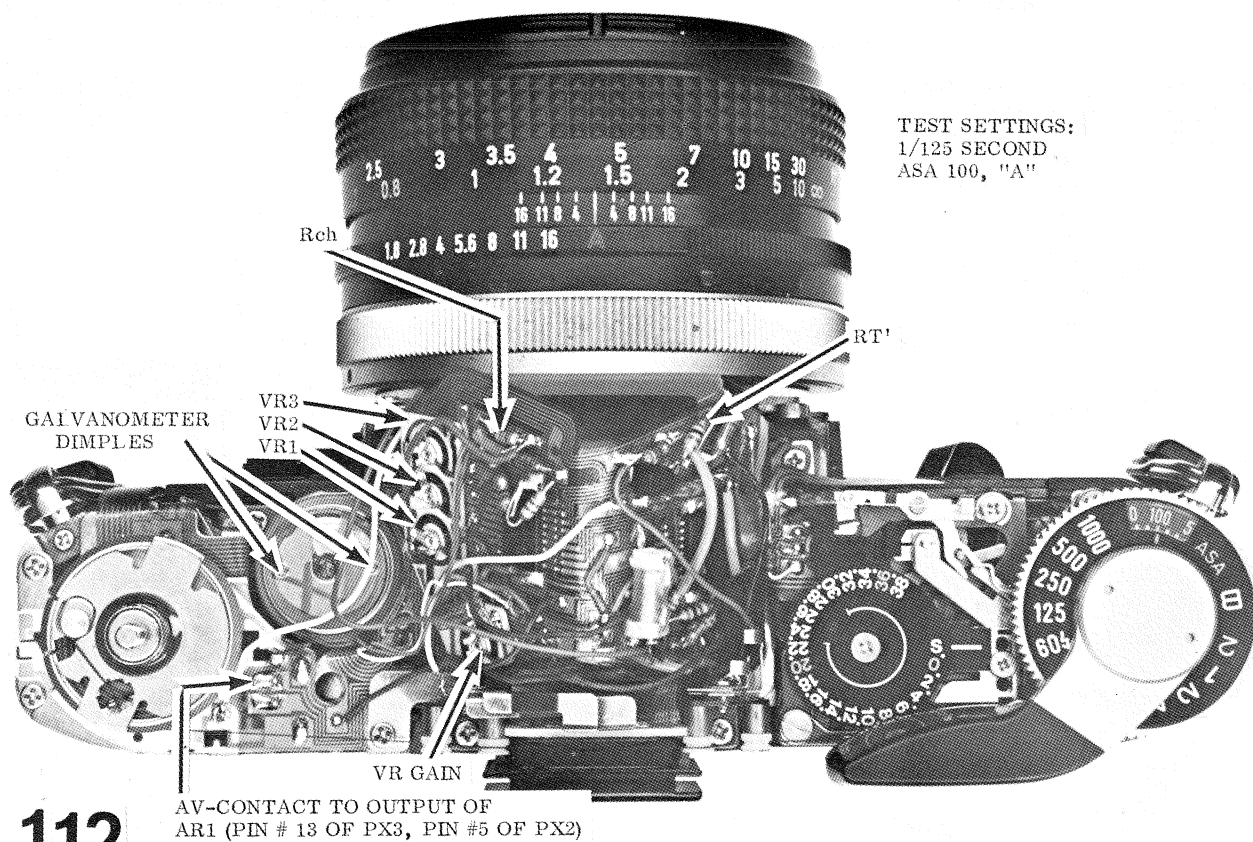
$$\text{Voltage AVO} = \frac{\text{APERTURE VALUE} - 4.5}{16} \times V_c + V_c$$

Use the aperture value of your largest lens opening. If you have the f/1.4 lens, the aperture value is 1. If you have the f/1.8 lens, the aperture value is 1.7.

Example: Suppose your measured V_c is 1.24 volts. And you're using the f/1.8 lens. Putting these values in the formula, you get:

$$\text{Voltage AVO} = \frac{1.7 - 4.5}{16} \times 1.24 + 1.24 = 1.023$$

So your measured voltage should be 1.023 volts. Measure VAVO between ground and pin #9 of PX 3. Or, rather than measuring to pin #9, you can measure to the white-wire connection indicated above. With switch SW1 closed, your measured voltage should be within 0.020 volt of your calculated voltage. If it isn't, make the adjustment using VR3.



2. GAIN ADJUSTMENT

The gain adjustment levels the slope so that equal changes in light input will cause equal output voltage changes. To make the gain adjustment, you must measure the output of AR1 at two different light levels. Subtracting these two values gives you the voltage change at the range of EV's covered by the difference in your light levels.

First, though, you must calculate what the voltage difference should be. Use the following formula:

$$\frac{V_c}{16} \times \text{EV RANGE}$$

For example, suppose again that your measured V_c is 1.24 volts. And your two light levels cover an EV range of 6 EV's -- such as EV15 and EV9. The formula then becomes:

$$\frac{1.24}{16} \times 6 = 0.465$$

Calculate and record your voltage difference _____

When checking the light transmission, you must shield the photocell from ambient light. Ambient light can cause a significant error, especially at the lower light levels. So you need a special tool -- a "dummy" top cover with clearance holes cut for the variable resistors.

Solder a long wire to the AV contact of the flex circuit (shown in Fig. 112). You'll make your voltage measurements between this wire and ground. Then, run the wire through the clearance cutout in the dummy top cover. And install the dummy top cover to shut out the ambient light.

Set your light source to EV 15 (f/16 light level on the Comparalumen or Autolumen-CV). Now, while holding the lens to the light source, close SW1. And measure the voltage between the test wire and ground. Record this voltage. EV 15 _____

Next, measure the voltage at EV 9 (f/2 light level on the Comparalumen or Autolumen-CV). Record this voltage.

EV 9 _____

Finally, subtract the voltage reading made at EV 9 from the reading at EV 15. This difference should equal your calculated voltage. If it doesn't, make the adjustment with the gain-control resistor VR gain. Your tolerance is ± 0.012 volt for a 6 EV range.

3. Δ AV LEVEL ADJUSTMENT

Make your Δ AV level measurement in the same manner as you made your gain measurements. But now you should get a specific voltage. Set the light level to EV 12 (f/5.6 on the Comparalumen or Autolumen-CV). Set the film speed on the camera to ASA 100, the shutter speed to 1/125 second, and the diaphragm to "A."

Before making your voltage measurement, compute what the reading should be. If you're using the f/1.4 lens, use the following formula:

$$\Delta AV = \frac{4.5 V_c}{16} + V_c$$

For any other lens, use the formula:

$$\Delta AV = \frac{4.5 V_c}{16} + V_c - (0.075 (\text{aperture value} - 1))$$

Notice that the only difference is that you're subtracting a value from the original formula. For the f/1.8 lens, the second part of the formula comes out 0.0525. So, if you're using the f/1.8 lens, subtract 0.0525 from the original formula.

Record the Δ AV level _____.

Now, measure the voltage between the temporary wire and ground at the specified settings. Your voltage reading should be within 0.020 volt of your calculated voltage. If it isn't, make your adjustment with VR1.

4. COMPARATOR ADJUSTMENT

Use the same light level (EV 12) and the same camera settings (ASA 100, 1/125 second, and "A"). Then, measure the light transmission. The lens should stop down to f/5.6 when you release the shutter.

If you don't have an instrument that measures light transmission, you can check the diaphragm opening visually. Release the shutter at the EV 12 light level. Then, turn the diaphragm-setting ring off the "A" position -- toward the manual f/stop settings.

Lock the stop-down lever in the stopped-down position. Then, while watching the diaphragm from the front of the lens, slowly turn the diaphragm-setting ring toward the larger apertures. The diaphragm will start to open at the last f/stop it automatically programmed. That f/stop should be f/5.6. So the diaphragm should start to open when you reach the f/5.6 setting.

5. METER ADJUSTMENT

At the settings in step #4, the meter should read f/5.6. The dimples in the top of the meter housing allow you to use a Multispan wrench to rotate the galvanometer. Turn the galvanometer housing until the needle indicates f/5.6.

6. BATTERY-TEST ADJUSTMENT

Remove the battery and hook a continuously variable power supply to the battery terminals. Set the power supply to 0 volt. Then, hold the release-button switches SW1 and SW2 depressed. And slowly raise the setting on the power supply until the shutter releases.

Record the voltage of the power supply at the time the shutter releases _____

Next, set the power supply according to your recorded release voltage. If the shutter released at a voltage setting of 4.2 - 4.39 volts, set the power supply to 4.6 volts. If the shutter released at a voltage setting of 4.4 - 4.59 volts, set the power supply to 4.7 volts. If the shutter released at a voltage setting of 4.6 - 4.8 volts, set the power supply to 4.7 volts.

With the power supply set to the proper voltage, push the battery-test switch SW8. The needle should move to the battery-test mark. If it doesn't, you can change the value of the fixed resistor Rch.

Temporarily replace Rch with a variable resistor that can be adjusted to either side 4.7 K. And adjust the variable resistor until the needle centers on the battery-test mark. Measure the resistance of the variable resistor to see what value you need for Rch.

CHECK FLASH EXPOSURE BY HOOKING 4.7 K RESISTOR BETWEEN
CCC CONTACT AND GROUND -- THE SHUTTER SHOULD DELIVER
1/60 SECOND

